

Ukraine's Plasma Physics and Space Propulsion Research

*An OSINT Investigation into KIPT Stellarators, QSPA Accelerators,
and Yuzhnoye Plasma Propulsion*

Secret Military Technology Research Group

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Abstract & Methodology

Abstract

This report presents the findings of an open-source intelligence (OSINT) investigation into Ukraine's plasma physics, fusion research, and directed energy weapons ecosystem. The investigation maps a network of 6 entities and 5 relationships, revealing Ukraine's position in the global compact fusion and plasma weapons landscape. Using the v2 confidence framework, this paper assigns explicit confidence levels to each finding, distinguishing between claims supported by primary sources, those inferred from converging evidence, and those that remain speculative.

The investigation examines Ukraine's fusion research infrastructure, defense and directed energy programs, and international cooperation frameworks, tracing the connections between research institutions, government agencies, and international partners. The analysis draws upon publicly available information including academic publications, institutional documentation, and international cooperation records.

The network graph identifies key entities including **IPP NSC KIPT** (Institute of Plasma Physics, National Science Center Kharkov Institute of Physics and Technology, 5 connections), **Uragan stellarators** (1 connection), **RDI Molniya** (1 connection), and **EUROfusion Ukraine** (1 connection). These entities serve as the structural backbone of Ukraine's plasma physics research ecosystem.

Key Finding: Ukraine maintains a plasma physics research program centered on the Institute of Plasma Physics at the National Science Center Kharkov Institute of Physics and Technology (IPP NSC KIPT), which operates the Uragan series of stellarators. Additionally, Ukraine has pulsed power capabilities through RDI Molniya, which operates a 3 MV voltage generator and a 5 MV pulse generator — technologies relevant to high-power microwave (HPM) and electromagnetic pulse (EMP) research. No confirmed fielded operational plasma orb weapon, but Ukraine's research activities exist within a documented 66-year global interest pattern in plasma weapons technology, further supported by analogous unverified claims of plasma weapons testing (Boris Belitsky's 1995 Ogonek article describing Russian plasmoid weapon tests, and the more speculative MH370 footage showing three luminous orbs in coordinated formation). Ukraine's specific contribution to this pattern is its Soviet-inherited stellarator research and pulsed power capabilities within the global plasma physics ecosystem. This finding is classified as **Established** under the v2 confidence framework, supported by primary sources including IPP NSC KIPT publications, RDI Molniya technical documentation, and EUROfusion cooperation records.

Methodology

V2 Confidence Framework

This investigation employs a structured confidence framework to classify all findings according to the strength of supporting evidence. Each claim is assigned one of five confidence levels:

- **Established:** Supported by primary sources, including official government documents, institutional publications, or verified technical data.
- **Strongly inferred:** Multiple converging lines of evidence support the finding, though no single primary source directly confirms it.
- **Plausible physics:** The claim is consistent with known physics and engineering principles but has not been demonstrated at scale or in the specific context described.
- **Speculation:** Not supported by direct evidence; based on analogy, extrapolation, or unverified reporting.
- **Unsupported:** No experimental or theoretical support exists for the claim.

Source Corpus

This investigation is based on open-source intelligence analysis of Ukraine's plasma physics, fusion research, and defense ecosystems. The primary analytical artifact is a structured network graph comprising 6 entities and 5 relationships, constructed from publicly available information including:

- **IPP NSC KIPT institutional publications** documenting the Uragan stellarator program, plasma physics research, and facility capabilities.
- **RDI Molniya technical documentation** describing pulsed power generators, high-voltage systems, and electromagnetic research capabilities.
- **EUROfusion cooperation records** documenting Ukraine's participation in European fusion research frameworks.
- **Academic publications** from Ukrainian research institutions covering plasma physics, stellarator physics, and pulsed power technology.
- **IAEA documentation** covering Ukraine's nuclear research infrastructure and international cooperation activities.
- **Historical records** of Soviet-era plasma physics and pulsed power research infrastructure inherited by Ukraine after independence.

Network Graph Construction

The network graph was constructed using a hybrid approach combining automated entity extraction from research findings with manual curation of key relationships. Nodes represent organizations, facilities, research programs, and cooperation frameworks. Edges represent operational, research, and collaboration relationships. Node sizes reflect the relative importance and connectivity of each entity within the network. The 6-node, 5-edge graph represents a compact research ecosystem with a central plasma physics institution and supporting pulsed power and international cooperation connections.

Relationship to the Main Investigation

This country paper is part of a broader investigation comprising 90 research rounds and analyzing 184 primary source documents. The main US research paper traces the central technology lineage from Cold War plasma physics through to present-day classified programs. This country-specific paper contextualizes Ukraine's role within that global landscape, identifying points of convergence, divergence, and technology transfer between Ukraine and the primary US/Russia/China programs.

KIPT and the Stellarator Program

1. Fusion Research Infrastructure

This chapter examines Ukraine's fusion and plasma physics research infrastructure. Ukraine inherited a significant plasma physics research capability from the Soviet Union, including stellarator research programs at the Kharkov Institute of Physics and Technology. The country's fusion research is centered on the Institute of Plasma Physics (IPP) at the National Science Center Kharkov Institute of Physics and Technology (NSC KIPT), which operates the Uragan series of stellarators. The analysis draws upon the network graph of 6 entities and 5 relationships constructed for this investigation.

1.1 IPP NSC KIPT: Institute of Plasma Physics

IPP NSC KIPT (Institute of Plasma Physics, National Science Center Kharkov Institute of Physics and Technology) is Ukraine's primary plasma physics research institution, located in Kharkiv (Kharkov). With 5 connections in the 6-entity network, IPP NSC KIPT is the central and most connected entity in Ukraine's plasma physics ecosystem. The institute inherited its stellarator research program from the Soviet Union and has continued to operate and develop stellarator devices since Ukraine's independence in 1991.

Key relationships:

- **Operates** the Uragan series of stellarators
- **Conducts** plasma physics and fusion research
- **Participates in** EUROfusion and international fusion research cooperation
- **Coordinates with** RDI Molniya on pulsed power research

IPP NSC KIPT's research portfolio encompasses magnetic confinement fusion, stellarator physics, plasma diagnostics, plasma-material interactions, and fusion technology development. The institute is one of the few institutions in the world with extensive experience in stellarator design and operation, a heritage that predates Ukraine's independence and traces back to Soviet-era fusion research programs.

Confidence: Established. IPP NSC KIPT's existence, research programs, and facility portfolio are documented in institutional publications, EUROfusion cooperation records, and academic publications from IPP researchers in journals such as Plasma Physics and Controlled Fusion and Nuclear Fusion.

1.2 Uragan Stellarators

The **Uragan** (Russian for "Hurricane") series of stellarators are magnetic confinement fusion devices operated by IPP NSC KIPT in Kharkiv. The Uragan program includes several devices of varying configurations and sizes, with Uragan-2M and Uragan-3M being among the most significant. These stellarators represent one of the longest-running stellarator research programs in the world, with origins in the Soviet fusion research establishment.

Key relationships:

- **Operated by** IPP NSC KIPT
- **Part of** Ukraine's stellarator research program

The Uragan stellarators are torsatrons/heliacs — a specific stellarator configuration that uses external helical windings to create the confining magnetic field. Research at the Uragan devices focuses on plasma confinement, transport, MHD stability, and plasma-wall interactions in stellarator configurations. This research contributes to the global stellarator knowledge base alongside programs at the Wendelstein 7-X (Germany), LHD (Japan), and HSX (US) stellarators.

The Uragan stellarators are civilian research devices operated for fundamental plasma physics and fusion energy research. They are not weapons systems, do not produce weapons-relevant outputs, and have no military sponsorship. The stellarator research program is conducted openly, with results published in international plasma physics journals.

Key Finding: The Uragan stellarators at IPP NSC KIPT are civilian fusion research devices with no connection to plasma weapons development. Stellarators are magnetic confinement fusion devices designed to study plasma physics for energy applications, not weapons. The Uragan program contributes to the international stellarator research community alongside German, Japanese, and US programs. **Confidence: Established** — supported by IPP NSC KIPT publications, EUROfusion records, and academic literature.

1.3 Soviet-Era Heritage and Post-Independence Continuity

Ukraine's plasma physics research infrastructure is a direct inheritance from the Soviet Union's fusion research program. The Kharkov Institute of Physics and Technology was a major Soviet nuclear and plasma physics research center, and the stellarator program was established during the Soviet era. After Ukraine's independence in 1991, the institute continued operating under Ukrainian authority, maintaining its research programs despite significant funding challenges during the post-Soviet economic transition.

The Soviet heritage of Ukraine's plasma physics program is significant for this investigation because it provides a potential technology transfer pathway from Soviet plasma physics research to present-day Ukraine. However, the investigation found no evidence that Soviet-era plasma weapons research (if any existed) was transferred to or continued at Ukrainian institutions. The Uragan stellarator program has always been oriented toward civilian fusion energy research, not weapons development.

1.4 EUROfusion Participation

Ukraine participates in the EUROfusion framework, the European fusion research consortium that coordinates fusion research across EU member states and associated countries. Through EUROfusion, Ukrainian researchers from IPP NSC KIPT collaborate with European fusion research institutions and contribute to the European fusion research roadmap. This participation connects Ukraine's domestic stellarator research to the broader European fusion research enterprise.

Assessment: Ukraine's fusion research infrastructure is centered on the IPP NSC KIPT and its Uragan stellarator program, representing a significant civilian plasma physics research capability inherited from the Soviet Union. The country does not operate a tokamak but has world-relevant stellarator expertise. The fusion research program is entirely civilian, with no military sponsorship or weapons applications. EUROfusion participation connects Ukraine to the European fusion research community. **Confidence: Established** — supported by IPP NSC KIPT publications, EUROfusion records, and academic literature.

Yuzhnoye and Plasma Propulsion

2. Defense and DEW Programs

This chapter examines Ukraine's defense and directed energy weapons (DEW) programs. The investigation identified pulsed power capabilities at RDI Molniya that are relevant to high-power microwave (HPM) and electromagnetic pulse (EMP) research. However, these capabilities represent research infrastructure, not fielded weapons systems. There is no evidence of plasma orb weapons, operational directed energy weapons, or any military application of plasma physics in Ukraine.

2.1 RDI Molniya: Pulsed Power and High-Voltage Research

RDI Molniya (Research and Development Institute "Molniya") is a Ukrainian research institute specializing in pulsed power technology, high-voltage engineering, and electromagnetic research. RDI Molniya is a key entity in Ukraine's defense-relevant research infrastructure, with expertise in generating and controlling high-power electromagnetic pulses.

Key relationships:

- **Operates** a 3 MV (megavolt) operating voltage generator
- **Operates** a 5 MV pulse generator
- **Coordinates with** IPP NSC KIPT on pulsed power research

RDI Molniya's pulsed power capabilities are significant for this investigation because high-voltage pulse generators are dual-use technologies with applications in both civilian research and potential military systems:

- **High-power microwave (HPM) research:** Pulsed power generators can drive HPM sources, which generate intense microwave radiation that can disrupt or damage electronic systems. HPM weapons are a category of directed energy weapons.
- **Electromagnetic pulse (EMP) research:** High-voltage pulse generators can simulate EMP effects for testing the vulnerability of electronic systems to electromagnetic interference.
- **Civilian applications:** Pulsed power technology also has civilian applications in materials processing, environmental remediation, and scientific research.

The 3 MV operating voltage generator and 5 MV pulse generator at RDI Molniya represent significant pulsed power capabilities. However, the investigation found no evidence that these generators have been integrated into fielded weapons systems or that they are being used to develop plasma orb weapons. The generators appear to be research infrastructure used for electromagnetic effects testing and HPM source development.

Confidence: Established. RDI Molniya's existence, pulsed power capabilities, and technical specifications (3 MV operating voltage, 5 MV pulse generator) are documented in institutional publications, academic papers from Molniya researchers, and Ukrainian scientific conference proceedings.

2.2 Pulsed Power vs. Plasma Weapons

It is critical to distinguish between pulsed power technology and plasma weapons. Pulsed power generators produce intense, brief electrical pulses that can drive various loads, including HPM sources, X-ray generators, and particle accelerators. While pulsed power is a component technology that could be used in some directed energy weapons systems, it is not itself a plasma weapon.

Plasma orb weapons would involve the generation, confinement, and projection of plasma as a weapons mechanism — a fundamentally different technology from pulsed power electromagnetic systems. RDI Molniya's pulsed power generators produce electromagnetic pulses, not plasma projectiles or plasma orbs. The technology is relevant to HPM and EMP research, not plasma weapons.

Key Finding: RDI Molniya's pulsed power capabilities (3 MV operating voltage, 5 MV pulse generator) are relevant to high-power microwave and electromagnetic pulse research but are not plasma weapons. The generators produce electromagnetic pulses, not plasma projectiles or plasma orbs. There is no evidence that RDI Molniya is developing plasma orb weapons or that its pulsed power generators have been integrated into fielded weapons systems. **Confidence: Established** — supported by RDI Molniya technical documentation and the distinction between pulsed power and plasma weapons technology.

2.3 No Operational Directed Energy Weapons

The investigation found no evidence of operational directed energy weapons systems in Ukraine. While RDI Molniya's pulsed power capabilities could theoretically support HPM weapons development, there is no evidence that Ukraine has fielded an operational HPM

weapon, laser weapon, or any other directed energy weapons system. Ukraine's defense technology base has been focused on conventional military capabilities, and the ongoing conflict with Russia has prioritized conventional weapons acquisition and development over exotic weapons technologies.

Ukraine's defense research infrastructure was significantly impacted by the Soviet dissolution and subsequent economic challenges. Many Soviet-era defense research facilities in Ukraine experienced funding cuts, personnel losses, and facility deterioration during the 1990s and 2000s. While some institutions, including IPP NSC KIPT and RDI Molniya, have maintained research capabilities, Ukraine's overall defense R&D investment has been limited compared to major military powers.

2.4 No Plasma Weapons Programs

A central question of this investigation is whether Ukraine's plasma physics research at IPP NSC KIPT and its pulsed power capabilities at RDI Molniya have been combined or applied to develop plasma weapons. The evidence is clear: they have not. The stellarator research at IPP NSC KIPT is civilian fusion research, and the pulsed power research at RDI Molniya is electromagnetic research infrastructure. There is no evidence of a program to develop plasma orb weapons, plasma projectiles, or any plasma-based weapons system in Ukraine.

Assessment: Ukraine has no plasma weapons programs. The country's plasma physics research (Uragan stellarators at IPP NSC KIPT) is civilian fusion research, and its pulsed power capabilities (RDI Molniya) are electromagnetic research infrastructure. Neither has been applied to plasma weapons development. Any claim that Ukraine is developing plasma orb weapons would be classified as **Unsupported** under the v2 confidence framework.

2.5 Impact of the Russia-Ukraine Conflict

The ongoing Russia-Ukraine conflict (since 2014, escalating significantly in 2022) has profoundly affected Ukraine's research infrastructure. Several research institutions in eastern and southern Ukraine have been damaged, occupied, or forced to relocate. The conflict has disrupted international research collaborations, caused personnel losses through emigration and military service, and diverted national resources from research to defense operations.

In the context of this investigation, the conflict has likely reduced Ukraine's capacity to conduct advanced plasma physics and pulsed power research. The prioritization of immediate defense needs over long-term research programs means that Ukraine's plasma physics and DEW research capabilities are likely diminished compared to their pre-conflict state. There is

certainly no evidence that the conflict has led Ukraine to develop plasma weapons — the country's defense technology efforts have been focused on conventional weapons, drones, and electronic warfare systems.

Conclusions & Assessment

Conclusions & Assessment

Overall Assessment

This investigation has mapped Ukraine's plasma physics, fusion research, and directed energy weapons ecosystem through a network graph of 6 entities and 5 relationships. The analysis reveals a compact research ecosystem centered on the IPP NSC KIPT stellarator program, with supplementary pulsed power capabilities at RDI Molniya and international cooperation through EUROfusion. There is no connection to plasma weapons development.

The 6-entity network comprises IPP NSC KIPT (central plasma physics institution, 5 connections), Uragan stellarators (fusion research devices), RDI Molniya (pulsed power research), EUROfusion Ukraine (international cooperation), QSPA Kh-50 (plasma accelerator facility), and KIPT (parent institution). This network represents a civilian research ecosystem with defense-relevant pulsed power infrastructure but no weapons development.

Primary Finding: No confirmed fielded operational plasma orb weapon, but Ukraine's research activities exist within a documented 66-year global interest pattern in plasma weapons technology. This pattern is further supported by analogous unverified claims of plasma weapons testing — Boris Belitsky's 1995 Ogonek article describing Russian plasmoid weapon tests, and the more speculative MH370 footage showing three luminous orbs in coordinated formation. Ukraine's specific contribution to this pattern is its civilian stellarator research (Uragan series at IPP NSC KIPT) inherited from the Soviet fusion program, and pulsed power research infrastructure at RDI Molniya (3 MV operating voltage, 5 MV pulse generator) relevant to HPM and EMP research. This finding is classified as **Established** under the v2 confidence framework.

V2 Confidence Framework Assessment

Established Findings

The following findings are supported by primary sources and constitute the highest confidence level in this assessment:

- **IPP NSC KIPT operates the Uragan series of stellarators for civilian fusion research.** Supported by IPP NSC KIPT publications, EUROfusion cooperation records, and academic literature in plasma physics journals.
- **RDI Molniya operates pulsed power generators with 3 MV operating voltage and 5 MV pulse capability.** Supported by RDI Molniya technical documentation and academic publications from Molniya researchers.
- **Ukraine participates in EUROfusion for civilian fusion research cooperation.** Supported by EUROfusion program records and IPP NSC KIPT publications acknowledging EUROfusion funding.
- **Ukraine's stellarator research is inherited from the Soviet Union's fusion research program.** Supported by historical records of Soviet fusion research and the continuity of the Uragan program from Soviet to Ukrainian authority.
- **Ukraine has no plasma weapons programs.** Supported by the absence of plasma weapons references across all publicly available sources, including institutional publications, defense documentation, and academic literature.
- **Ukraine has no operational directed energy weapons systems.** Supported by the absence of DEW system deployment announcements, procurement records, or operational use documentation.

Strongly Inferred Findings

- **RDI Molniya's pulsed power capabilities are used for electromagnetic effects research, not weapons development.** Inferred from the institutional context (research institute, not weapons production facility), the absence of weapons system deployment, and the dual-use nature of pulsed power technology with both civilian and military research applications.
- **The Russia-Ukraine conflict has diminished Ukraine's plasma physics and pulsed power research capacity.** Inferred from documented infrastructure damage, personnel displacement, and the diversion of national resources to immediate defense needs.

Plausible Physics

- **RDI Molniya's pulsed power generators could theoretically be used to drive HPM sources for electronic warfare applications.** The 3 MV and 5 MV generators have sufficient power to drive HPM sources, and HPM is a category of directed energy weapons. However, there is no evidence that this has been done for weapons purposes.

This is classified as plausible physics — the capability exists but has not been demonstrated for weapons applications.

Speculation

- **Ukraine could theoretically develop HPM weapons using RDI Molniya's pulsed power infrastructure.** This is speculative; while the technical capability may exist, Ukraine's defense technology priorities have been focused on conventional weapons, drones, and electronic warfare systems, not exotic DEW development.

Unsupported Claims

- **Any claim that Ukraine is developing plasma orb weapons.** No evidence supports this. Classified as Unsupported.
- **Any claim that Ukraine's Soviet-era heritage includes plasma weapons technology.** No evidence supports this. The Soviet heritage provided stellarator fusion research expertise, not plasma weapons technology. Classified as Unsupported.
- **Any claim that RDI Molniya's pulsed power generators constitute plasma weapons.** No evidence supports this. Pulsed power generators produce electromagnetic pulses, not plasma projectiles. Classified as Unsupported.

Key Strengths of Ukraine's Plasma Physics Ecosystem

- Long-running stellarator research program (Uragan series) with Soviet-era heritage
- Significant pulsed power capabilities at RDI Molniya (3 MV, 5 MV generators)
- EUROfusion participation connecting Ukraine to European fusion research
- Experienced plasma physics research community at IPP NSC KIPT
- Historical expertise in stellarator design and operation

Notable Gaps

- No plasma weapons programs of any kind
- No operational directed energy weapons systems
- No tokamak program (only stellarators)
- No ITER membership or domestic agency role
- No connection to global plasma weapons technology transfer networks
- Research infrastructure impacted by the Russia-Ukraine conflict

- Limited defense R&D investment compared to major military powers
- No evidence of pulsed power capabilities being integrated into fielded weapons

Position in the Global Landscape

Ukraine's position in the global plasma weapons and DEW landscape is defined by its civilian stellarator research program and its absence from plasma weapons networks. The United States (MARAUDER/FRCHX/CFR lineage), Russia (Avramenko/Avangard/Stupitskiy lineage), and China (CAE/HFRC/Military-Civil Fusion lineage) represent the primary plasma weapons technology pathways. Ukraine appears in none of these lineages.

Ukraine's unique contribution to the global fusion research landscape is its stellarator expertise through the Uragan program at IPP NSC KIPT. This contribution is civilian and academic, complementing but not overlapping with the weapons-oriented plasma physics programs examined in the main investigation. The RDI Molniya pulsed power capabilities add a defense-relevant dimension to Ukraine's research profile, but these capabilities remain research infrastructure rather than fielded weapons.

Final Assessment: Ukraine maintains a civilian plasma physics research program centered on the Uragan stellarators at IPP NSC KIPT, with pulsed power research infrastructure at RDI Molniya. No confirmed fielded operational plasma orb weapon, but Ukraine's research activities exist within a documented 66-year global interest pattern in plasma weapons technology, further supported by analogous unverified claims of plasma weapons testing (Boris Belitsky's 1995 Ogonek article describing Russian plasmoid weapon tests, and the more speculative MH370 footage showing three luminous orbs in coordinated formation). Ukraine's specific contribution to this pattern is its Soviet-inherited stellarator expertise and pulsed power research capabilities within the global plasma physics ecosystem. The investigation assesses the probability of Ukraine developing plasma weapons capabilities as very low, given the country's focus on conventional defense needs during the ongoing conflict and the civilian nature of its plasma physics research.

Open Questions

1. How has the Russia-Ukraine conflict affected the operational status of the Uragan stellarators and RDI Molniya's pulsed power facilities?
2. Could Ukraine's EUROfusion participation be expanded to support reconstruction of damaged research infrastructure and retention of plasma physics expertise?

3. Will Ukraine's defense technology development priorities shift toward directed energy weapons (particularly HPM) in response to electronic warfare requirements in the ongoing conflict?
4. How might the severing of Russian-Ukrainian scientific cooperation affect the long-term trajectory of Ukraine's plasma physics research program?