

§9. Efforts towards Onset of Confinement Research in Institute of Plasma Physics, Nagoya Univ. in 1960's

Matsuoka, K., Namba, C., Kimura, K., Hanaoka, S., Obayashi, H., Fujita, J., Terashima, Y. (Nagoya Univ., Professor Emeritus)

In referring to the history of fusion research for making the flow diagram of remarkable events for the special issue on the 50<sup>th</sup> anniversary of fusion community it was found that the activities of Institute of Plasma Physics, Nagoya Univ. had not been described in any writing, that bridge basic-plasma-physics studies by using the linear machines at the early phase of IPP and the later confinement studies with the toroidal machines such as JIPP-1 stellarator.

The IPP Nagoya Univ. was established in 1961 on the basis of the so-called A-plan that gave priority to basic-plasma-physics studies over the construction of medium-sized confinement machines in operation abroad at that time such as stellarator and mirror. The devices such as QP, TP, and BSG were designed to extract essence of plasma physics, and as a corollary, were of uniform magnetic field to exclude complicating effects arising from magnetic field curvature and gradient. One of topics was wave-plasma interaction in quiet plasmas heated with ICRH and so on.

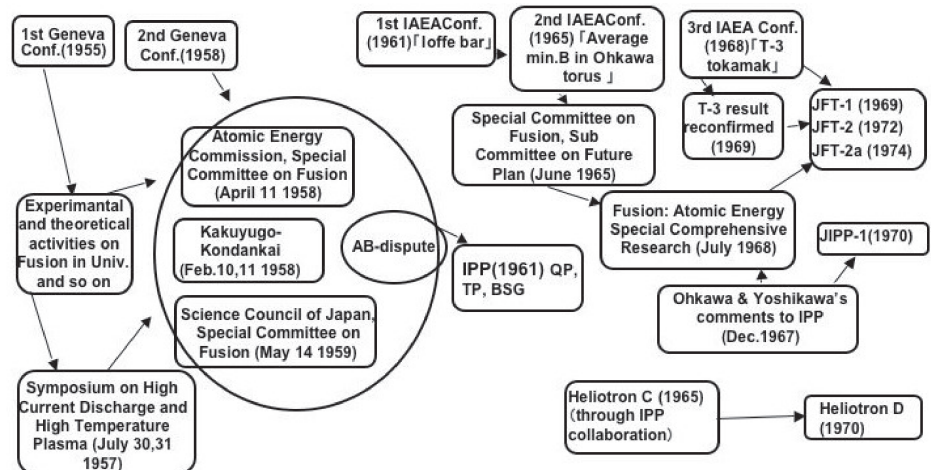
In 1960's the fusion research in the world was in the course of demonstrating the guiding principle of the magnetic well. The idea was first reported at the first IAEA conference in 1961 by Ioffe. Later Ohkawa demonstrated the effectiveness of average minimum B at the second IAEA conference in 1965. In 1968 Kurchatov Institute (KI) announced that T-3 tokamak achieved the electron temperature of 1 keV measured with diamagnetic loop. The result was reaffirmed in 1969 with Thomson scattering by the joint team of KI and Culham Laboratory, where D. C. Robinson played a major role. In general, tokamaks satisfy the min. average B condition. This result formed the tokamak boom all over the world.

IPP presented three results on plasma heating in QP, BSG and TPM at the third IAEA Conference in 1968, however, these topics did not keep with the trend of magnetic confinement, unfortunately. Because of this, it is miscomprehended that IPP was forced to direct to confinement

research by external pressures. However, the discussion on the importance of confinement studies had been continued in IPP since its foundation in 1961. Such efforts shown in the minutes of the steering committee of IPP are listed below by a run of the item.

- 1) Discussion on Future Plan (Feb. 1962). T. Ohkawa and S. Yoshikawa were recommended as a core member of promoting FP among big names.
- 2) Heliotron was recommended to promote in Kyoto Univ. as one of FP. (May 1963)
- 3) Husimi's comment (Dec. 1965): IPP should squarely address the confinement problem.
- 4) Review meeting on min. B was held in Jan. 1966.
- 5) Budget request of FY 1967 on "Plasma generation and injection in toroidal magnetic field" in Feb. 1966.
- 6) Husimi's report on International workshop on torus plasma held at Princeton. Ohkawa-torus and Spherator by Yoshikawa were introduced. (Aug.1966)
- 7) Husimi tried to invite Ohkawa as a professor without discussion of the steering committee. (Dec.1966)
- 8) Yoshikawa's report on internal conductor experiment in USA. Husimi made a statement in March 1967 that Yoshikawa was one of candidates of leader to promote confinement study in IPP.
- 9) Comments on the status of IPP by Ohkawa and Yoshikawa were published in Kakuyugo-Kenkyu in Dec. 1967. This report has been understood as an external pressure to IPP.
- 10) Start of examination of plans advertised for high temperature plasma confinement. (March 1968)
- 11) Ikuta-torus was evaluated, but it had small rotational transform. He was recommended to continue paper work. (Oct. 1968)
- 12) JIPP-I stellarator proposed by Miyamoto had magnetic well and rotational transform. (May 1969)

*This work was conducted under NIFS Collaborative Research Program NIFS05KVXJ004.*



Flow diagram of Fusion Research in 1960's