Fusion News: May to July 2019

Here are some of the big news stories in nuclear fusion, that you might have missed:

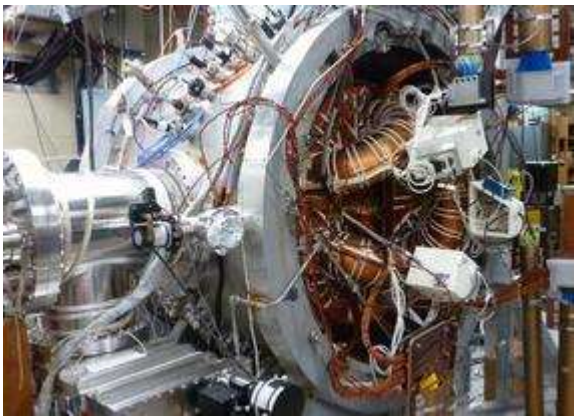
1. **Commonwealth Bulks Up**. On June 27th 2019, Commonwealth raised $115 million in a Series A funding round. This was not a big surprise, given that Commonwealth is (and will continue to be) the heavyweight in fusion startups. CFS has a team of more than 60 people. MITs' full weight and by extension the rest of Boston, is supporting them. The Alacator C-MOD Tokamak had a long a rich scientific history and when tokamaks are combined with advances in superconductors, it will be a potent mix. CFS had already raised 75 million going into this round. 50 million was from Eni, an Italian oil company in March of 2018 and the rest was from Breakthrough Energy Ventures in the summer of 2018.

2. **China Poaches Top US Fusion Expert.** From May 26th to 28th China hosted an alternatives fusion approach conference in the city of Xi'an. The conference focused on non-tokamak and featured talks on magneto-inertial fusion (MIF), heavy ion-beam ICF, plasma liner fusion and magnetic mirrors. America has no magnetic mirror machines anywhere our country; despite calls from US experts like Dr. Ken Fowler, Dr. Ralph Moir and Dr. Simeon to do so. Guests were given a tour of the new fusion effort taking flight the ENN energy holdings. ENN is a billion-dollar energy company in central china that has started a private fusion research effort. The company is flush with cash. They have sunk ~10 million over 2 years into duplicating the Princeton Field Reversed Configuration over in China; they have also hired a staff of 30 to drive the effort. ENN also has plans to build a 1 Mega-Amp Spherical Tokamak. To make matters worse, after the conference, a top fusion scientist - Dr. Francis Thio – was hired away from his position as CEO of HyperJet fusion. Dr. Thio previously served as a program manager at the DOE. Dr. Thio is an expert in

plasma liner fusion – a technology that the US has a healthy lead in - and that China had *not* been previously pursuing.

STELLAR
ENERGY FOUNDATION

3. **Fusion Foundation Takes Flight**. On June 13th 2019, the Stellar Foundation made its' debut, hosting a conference in lower Manhattan. This group is angling to become a new foundation (a 501c3) for fusion research – supporting innovative or breakthrough research in this space. The conference was a private event, bringing together about 100 people. The crowd was a healthy mix of investors and fusion experts. Stellar is principally backed by Dr. Jesse Treu, a man worth over half a billion dollars, who made his fortune in biotech investing. The team also features Jane Hotchkiss – who advocated and worked in solar energy for 20 years before moving into the fusion space in 2011.



4. **CT Fusion Wins 3 Million**. On June 13th 2019, CT Fusion cleared the last government hurdle and was award several million from ARPA-E to develop their Dynomak concept. The Dynomak developed from the HIT-SI spheromak at the University of Washington within Dr. Tom Jarboes' group. It has several key advantages over a conventional tokamak – but has enough similarities that much of the theory, codes and expertise of the tokamak can be applied. A key innovation of the Dynomak is the use of Helicity injection; first published by the group in 2011. This is where a wobble is imposed on a self-sustaining loop of plasma. By imposing a wobble, the company can eliminate a spheromak plasma instability, effectively heat the material and reduce the number of magnets needed in the machine.

5. **Horne Technologies Secures Investors**. On July 4th 2019, Denver-based Horne Technologies secured angel investment from Free Radical Ventures. The funding will allow Horne to continue developing a superconducting Biconic Spindle Cusp. The closest relative to this approach is the Compact Fusion Reactor approach pursued by Lockheed-Martin. At the core of both approaches is the idea that the plasmas' internal magnetic properties would reject the surrounding magnetic field – leading to an awesome magnetic trap. Horne was one of the first companies to apply superconducting wire to the problem of fusion plasma, back in 2011. Superconductors can lead to a 1 million-fold increase in run time and a 1,000X increase in magnetic field strength, over capacitor-driven copper wire systems. This improvement allows for small firms to explore new fusion conditions inaccessible to bigger players just a few years ago. Horne hopes to exploit the new superconducting wire to explore new magnetic (5 Tesla) and plasma densities.

INFUSE Innovation Network for Fusion Energy

6. **DOE Announces new INFUSE STTR program**. On June 4th the Department of Energy announced INFUSE, a new effort to pair national laboratories with private companies. The program is being partially managed by Dr. Ahmed Diallo from Princeton. To apply for the grant a private company must partner with a national laboratory and write an STTR application. This funding is

low in total dollars for the business. A typical Phase I STTR is about 100K in funding, with the business getting about 40% of that money. However, the INFUSE program will allow companies to get major experiments done at the national laboratories. It will allow them to do big experiments on large scale equipment.

RENAISSANCE FUSION

HelicitySpace

7. **<u>Two New Companies Join Fusion Industry Association</u>**. In early June, the Fusion Industry Association added two new companies to their members' list. The first one was Helicity Space; located in Berkeley California and formed in 2018. The company is building on the technology developed by Dr. Setthivoine You, formally of the University of Washington, Caltech and Imperial College. The company is focused on designing a fusion-driven rocket engine. Their approach is to inject helical filaments of plasma into a magnetic nozzle. When the plasma reaches the center the fields reconnect – releasing energy into the plasma and kicking off fusion reactions. The resulting plasma has been heated by the reconnection and fusion event – it escapes out the back of the rocket. Notably, Helicity also has Dr. Stephane Lintner a former managing partner at Goldman Sacks involved in their day to day operations. The other company was Renaissance Fusion, which was founded by Dr. Francesco Volpe from Columbia University. Renaissance Fusion is an EU based startup aiming to develop subsystems for stellorators and tokamaks. The company will be at the 2019 European Physical Society Conference in Milan.

8. **<u>Fusion Podcast & Fusion Shark Tank</u>**. In June, a new *Fusion Shark Tank* forum was launched with two talks from CT Fusion and Princeton Satellite Systems. The forum is a 30 minute platform, where startups can pitch their technologies to interested investors. If you are an investor interested in learning more about the forum please email Dr Matt Moynihan. Also in July, a new interview premiered on The Fusion Podcast (www.thefusionpodcast.com) with Mr. Richard Dinan. Mr. Dinan is the CEO of Pulsar Fusion, a London-based company that was founded in 2015. Mr. Dinan is the author of "The Fusion Age: Modern Nuclear Fusion Reactors" and has raised several million dollars in private investment.