Fibrillar structures as means of energy transport in the solar chromosphere

In a close international collaboration, researchers at the University of Oslo have moved one step closer to understanding the mysterious heating of the Sun's atmosphere, thanks to high-resolution observations provided by several advanced facilities around the globe.
In particular, the research focuses on the chromosphere, which is a highly structured layer of the Sun's atmosphere. This layer exhibits fibrillar structures of different physical properties. These structures have been shown to be a good proxy for geometry of the magnetic fields. Due to instrumental limitations, these features had been studied so far in the upper chromosphere and beyond, and less so in the lower heights from where the energy required for the atmospheric heating likely originates.
Now, a study led by Dr Shahin Jafarzadeh of the University of Oslo, in collaboration with scientists from the Max Planck Institute for Solar System Research and four other institutions in Germany, Spain, and USA, has used high-resolution images recorded by the SUNRISE balloon-borne solar observatory (see Fig. 1) to reveal for the first time that slender fibrillar structures in the low solar chromosphere carry various kinds of magnetohydrodynamic waves that are energetic enough to heat the solar atmosphere.

Illustration 1: An image of the SUNRISE balloon just before its launch. Image credit: NASA

Furthermore, within another project funded by the European Research Council (ERC), Dr Jafarzadeh and his collaborators have exploited multi-height observations of the solar atmosphere from the Interface Region Imaging Spectrograph explorer (IRIS; a NASA space telescope), complemented by the first direct measurements of the chromospheric temperature with the Atacama Large Millimeter/submillimeter Array (ALMA; the world largest astronomical facility) to suggest that many of the thread-like structures are possibly extended, as either discrete or connected events, throughout the entire solar chromosphere and beyond.
These complementary studies of the fibrillar structures at high resolution provide essential information about one of the most promising means of the energy transport through the solar atmosphere. In summary, we find fibrillar structures in the solar chromosphere as extended wave-guides which channel energy into the upper solar atmosphere. Yet a newer solar instrument 'CHROMIS', which has recently been installed on the Swedish 1-m Solar Telescope (SST) in La Palma (Canary islands, Spain), facilitates multi-layer observations of the entire solar chromosphere at presently the highest resolution. Ultimately, such observations will shed light on the role and the nature of fibrillar structures in the solar chromosphere.

My homepage at the university's website (with links to my recent papers
and to all instruments I have mentioned above):
http://www.astro.uio.no/english/people/aca/shahinj

Contact: Shahin Jafarzadeh (shahin.jafarzadeh@astro.uio.no)