Absence of Stellar Pulsations Baffles Astronomers

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Readings done by a Canadian-Austrian team present **a puzzle for astronomers**. Expected surface phenomena, which provide information about stellar structures, could not be evidenced from readings obtained by means of a Canadian microsatellite. The precise satellite readings leave no doubt on the data published in NATURE. The project, organised in co-operation with the Institute of Astronomy at the University of Vienna and supported by the Austrian Science Fund (FWF), challenges the existing understanding of the structure of stars.

The phenomenon of pressure-driven oscillations at the surface of the sun has been known for more than 25 years. Astronomers use these pulsations to gain knowledge on the structure of the sun. Prof. Werner W. Weiss and his team from the Institute for Astronomy at the University of Vienna together with a Canadian team could for the first time conduct such observations on another star using a Canadian microsatellite. But contrary to all findings of terrestrial studies and previous calculations, there is no evidence for the surface pulsations.

"Good Vibrations" of the Stars

Prof. Weiss illustrates the astronomers' interest in the surface pulsations thus: "It sounds paradoxical, but the surface pulsations provide us with knowledge of stellar structures. Just as seismology explores the interior of the earth by measuring quakes, the new discipline known as asteroseismology analyses the surface pulsations of stars to study their structures." One uses oscillations caused by these pulsations that move to the stellar core, where they are reflected and thrown back to the surface.

The oscillations vary according to the nature of the surroundings and are measurable, thus providing indirect information about the interior of a star.

However, the surface pulsations cannot be directly measured. So the asteroseismologists measure the slight variations in the light intensity caused by these pulsations. The newest tool to be employed in this study is the Canadian microsatellite known as MOST (Microvariability and Oscillations of Stars) that is managed by Prof. Jaymie Matthews at the University of British Columbia, Canada. The satellite is situated 820 km above the earth and measures the light intensity of remote stars.

"The earth's atmosphere is really cumbersome for measuring light. It works like a filter. MOST avoids this problem with a telescope that penetrates deep into space. Thus with a telescope of aperture 15 cm, we can achieve a higher precision in observation of a bright star than with an eight-metre telescope from earth," explains Prof. Weiss. The precision of the satellite telescope was actually confirmed by control surveys, which data was also received by a Viennese earth station, financed by the Austrian Space Agency and developed by the Vienna University of Technology.

Contradictory Findings = New Questions

The MOST's first object for readings was Procyon, a star that lies in the constellation of Orion when viewed from the earth. Seven independent readings from the earth as well as theoretical calculations anticipated a minimum of 0.002% of oscillations of light intensity caused by pulsations, which was not a problem for MOST that can read oscillations up to 0.0003%. For all the precision, no significant surface oscillations could be determined for Procyon.

Prof. Weiss states: "This finding has interesting consequences for astronomy. It is possible that other gaseous movements, created by

temperature differences at the surface of the star, cause an interfering signal that is superimposed on our readings. Then our data will be exceptionally valuable for future readings. It can also be that we must review our model calculations."

Astronomers would then be required to critically question the current knowledge about the inner structure of stars. The fact that even a budding specialist discipline such as asteroseismology challenges the foundation of a scientific area is a significant point for FWF. For it assuredly advances its adherence to creativity, quality and innovation as the most important criteria for funding.

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