HD 30963 is a chemically peculiar star, study finds

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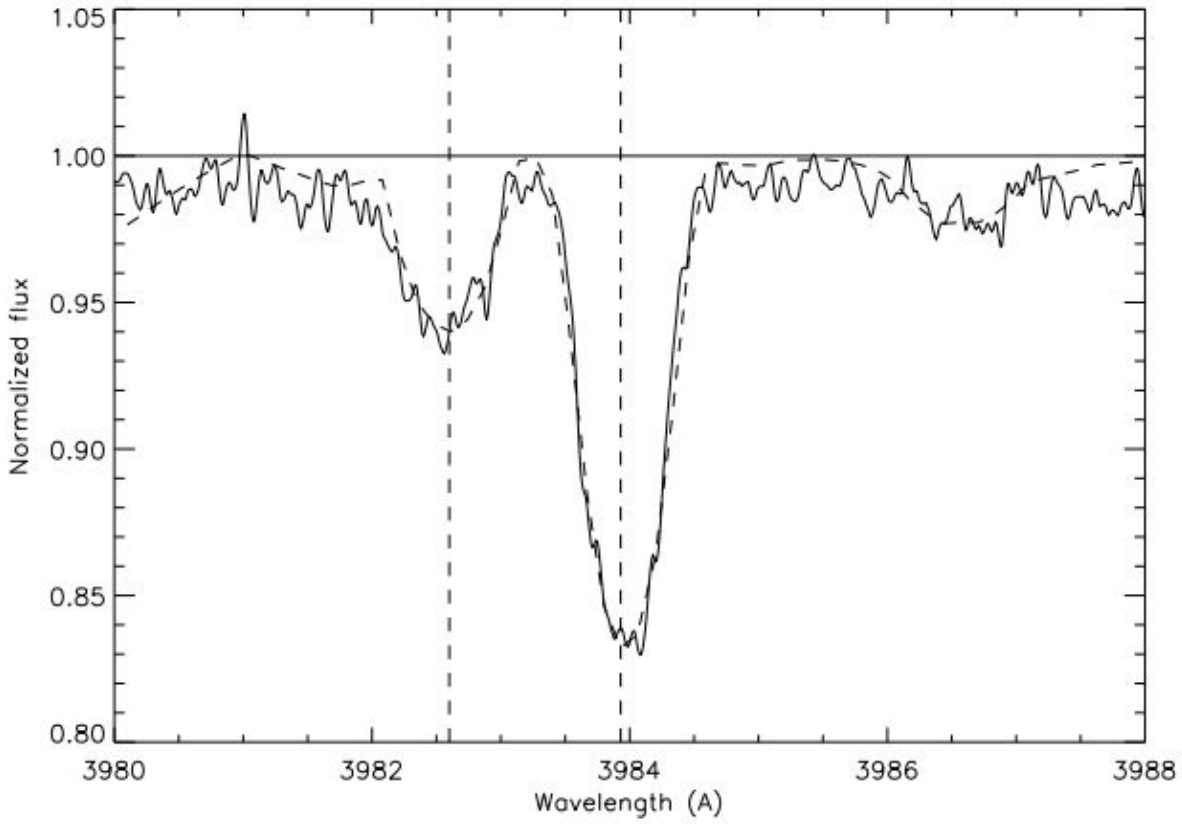

Synthesis of the Hg II 3983.93 ˚A line (observed: thick line, models: dashed lines). Credit: arXiv:1609.03542 [astro-ph.SR]

(Phys.org)—New research conducted by a team of astronomers from the Paris Observatory in Meudon, France and the Notre Dame University –

Louaize in Zouk Mosbeh, Lebanon, reveals that a B-type main-sequence star designated HD 30963 has unusual metal overabundances. The findings were presented in a paper published Sept. 12 on the arXiv pre-print paper.

HD 30963 was classified by previous studies as a B9 III superficially normal star; however, the new research showing abnormal metal abundances, including overabundances of mercury (Hg) and manganese (Mn), indicates that the star should be reclassified as a B9 HgMn star.

The team, led by Richard Monier of the Paris Observatory, observed HD 30963 on five consecutive days in late 2015 using the SOPHIE high-resolution echelle spectrograph installed on the 1.93m reflector telescope at the Haute-Provence Observatory in southeastern France. These observations were part of a broader project aiming to reclassify late B stars in the northern hemisphere.

According to the study, analysis of the data provided by SOPHIE shows that HD 30963 has very high abundances of Hg and Mn, as well as platinum (Pt), yttrium (Y) and zirconium (Zr), larger than 50 times the solar values. The overabundance of Hg is extremely high reaching value of about 150,000 times the solar abundance.

The researchers also found underabundances of helium (He) and nickel (Ni), about 0.2 and 0.1 of the solar value respectively. This, combined with overabundances of such elements as Hg and Mn, indicate that HD 30963 is a HgMn late B star.

"We show that this star, hitherto classified as a B9 III superficially normal star, is actually a new chemically peculiar star of the HgMn type. Spectrum synthesis reveals large overabundances of Mn, Sr, Y, Zr , Pt a nd Hg and pronounced underabundances of He and Ni which are characteristic of HgMn stars. We therefore propose that this interesting

object be reclassified as a B9 HgMn star," the scientists wrote in the paper.

HgMn stars are a subclass of chemically peculiar stars—main-sequence A and B stars with unusually strong or weak lines for certain elements. Besides their chemical composition, they experience very slow rotation with an average velocity of 29 km/s, which leads to extremely sharp-lined spectra. At present, more than 150 HgMn stars are known, and many of them were found in young associations.

Chemically peculiar stars like HD 30963 have magnetic fields, and are therefore great natural atomic and magnetic laboratories for scientists. They are perceived as the best objects for learning about magnetic field models, which could be applied to other classes of stars.

Although HD 30963 was recently investigated by the team, which resulted in its reclassification, very little is yet known about this object. The researchers assume that it has a radius ranging from three to four solar radii and the upper limit of its rotational period is estimated to be 4.12 days.

Currently, the team is conducting further studies of HD 30963 focused on more detailed abundance analysis.

"We are currently performing a detailed abundance analysis of HD 30963 to complement the first abundances presented here," the paper reads.

More information: HD 30963: a new HgMn star, arXiv:1609.03542 [astro-ph.SR] arxiv.org/abs/1609.03542

Abstract
Using high dispersion high quality spectra of HD 30963 obtained with

the echelle spectrograph SOPHIE at Observatoire de Haute Provence in November 2015, we show that this star, hitherto classified as a B9 III superficially normal star, is actually a new Chemically Peculiar star of the HgMn type. Spectrum synthesis reveals large overabundances of Mn, Sr, Y, Zr , Pt and Hg and pronounced underabundances of He and Ni which are characteristic of HgMn stars. We therefore propose that this interesting object be reclassified as a B9 HgMn star.