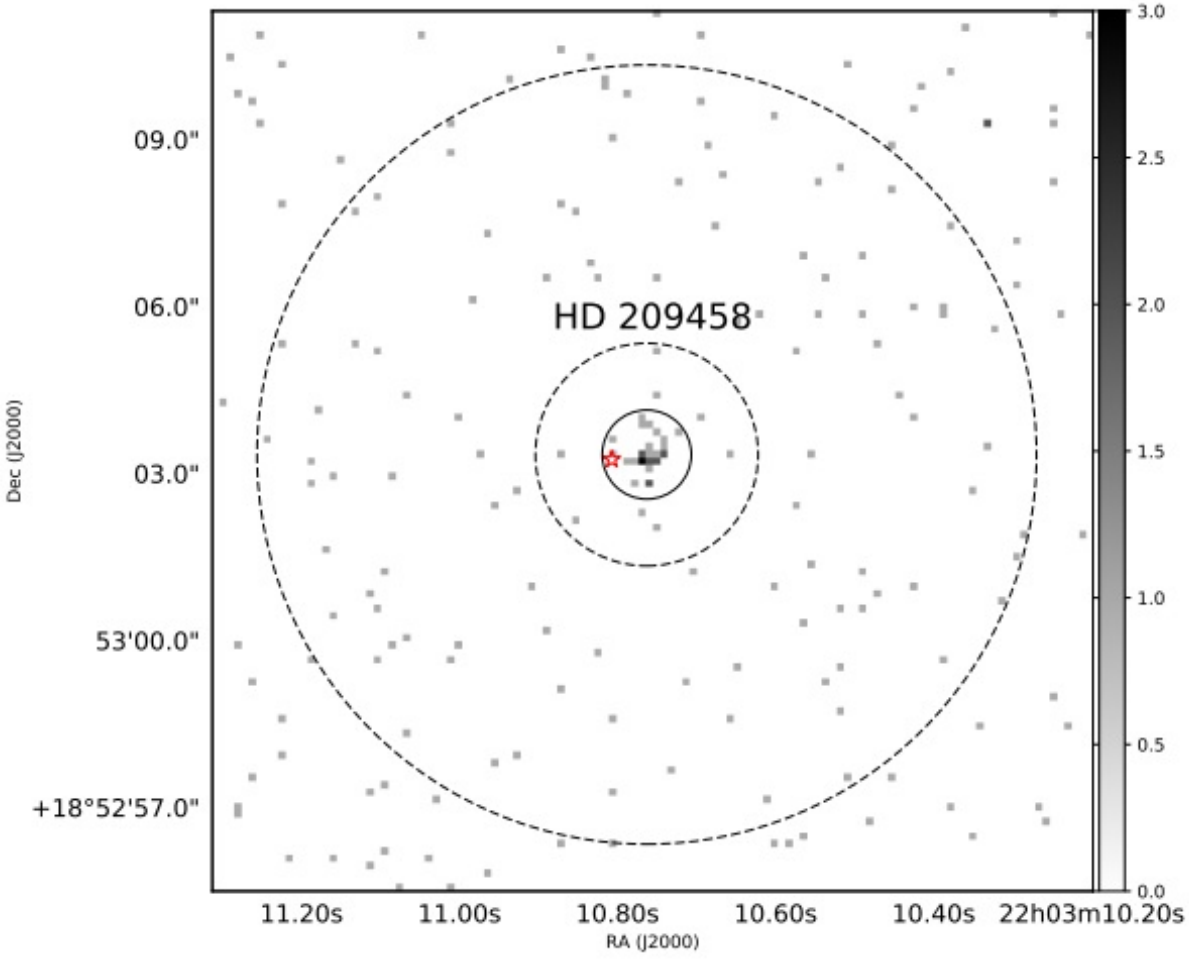
# X-ray observations reveal new details about the solar-type star HD 209458

August 21 2017, by Tomasz Nowakowski




Chandra HRC-I image of HD 209458. Credit: Czesla et al., 2017.

(Phys.org)—By analyzing sets of data obtained by two X-ray space observatories, a team of German researchers has learned new insights into the nature of a solar-type star known as HD 209458. The new study, published Aug. 15 in a paper on arXiv.org, uncovers X-ray properties of the star.

Located some 160 light years away from the Earth, HD 209458 is a G-type main sequence star very similar to our sun. It has a radius of about 1.2 solar radii and is approximately 13 percent more massive than the sun. The star is orbited by a so-called "hot Jupiter" exoplanet, circling it every 3.5 days at a distance of about 0.047 AU.

HD 209458 has a relatively high rotation velocity. With a rotation period of 14.4, it rotates at about twice the solar rate. However, it is a rather inactive star, and despite its critical role in planetary mass loss, the star's X-ray spectrum and luminosity have not yet been thoroughly studied and remain controversial. Previous measurements of the star's soft X-ray flux are based on the available data from ESA's X-ray Multi-Mirror Mission (XMM-Newton) spacecraft, which suffer from significant background contamination, complicating the analysis of HD 209458.

So a team of astronomers led by Stefan Czesla of the University of Hamburg, Germany, has complemented the XMM-Newton data with new observations from NASA's Chandra X-ray Observatory. The combined analysis of the data provided by these two spacecraft allowed the researchers to obtain more details about X-ray properties of HD 209458.

"We carry out a detailed analysis of our new Chandra HRC-I data, the available archival XMM-Newton observations and, finally, present a combined analysis of both data sets," the authors wrote in the paper. The team's analysis includes XMM-Newton data provided by observations conducted in 2000 and 2006, and a new Chandra dataset obtained thanks

to observations carried out in June 2016. All these data deliver crucial information about HD 209458's coronal X-ray emission and planetary irradiation.

According to the study, HD 209458 was confirmed to be an X-ray source. The analysis shows that the star has a coronal temperature of about one million K and an emission measure of approximately 70 quindecillion $cm^{-3}$, which indicates an X-ray luminosity of about 1.6 octillion erg $s^{-1}$ in the 0.124-2.48 keV band.

The researchers compared these results with the properties of other known stars, including our sun. "With respect to coronal temperature, HD 209458 appears to be comparable to the inactive sun or Cen A," the paper reads. Furthermore, the team noted that the level of planetary atmospheric irradiation is sufficient to drive planetary evaporation at a rate of a few times ten billion g $s^{-1}$.

"At this level of activity, the planetary high-energy emission is sufficient to support mass-loss at a rate of a few times $10^{10}$ g $s^{-1}$," the researchers concluded.

**More information:** arxiv.org/pdf/1708.04537.pdf