A survey for near-infrared H2 emission in Herbig Ae/Be stars: emission from the outer disks of HD 97048 and HD 100546

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(Submitted on 11 Jul 2011)

We report on a sensitive search for H2 1-0 S(1), 1-0 S(0) and 2-1 S(1) ro-vibrational emission at 2.12, 2.22 and 2.25 micron in a sample of 15 Herbig Ae/Be stars employing CRIRES, the ESO-VLT near-infrared high-resolution spectrograph, at R~90,000. We detect the H2 1-0 S(1) line toward HD 100546 and HD 97048. In the other 13 targets, the line is not detected. The H2 1-0 S (0) and 2-1 S(1) lines are undetected in all sources. This is the first detection of near-IR H2 emission in HD 100546. The H2 1-0 S(1) lines observed in HD 100546 and HD 97048 are observed at a velocity consistent with the rest velocity of both stars, suggesting that they are produced in the circumstellar disk. In HD 97048, the emission is spatially resolved and it is observed to extend at least up to 200 AU. We report an increase of one order of magnitude in the H2 1-0 S(1) line flux with respect to previous measurements taken in 2003 for this star, which suggests line variability. In HD 100546 the emission is tentatively spatially resolved and may extend at least up to 50 AU. Modeling of the H2 1-0 S(1) line profiles and their spatial extent with flat keplerian disks shows that most of the emission is produced at a radius >5 AU. Upper limits to the H2 1-0 S(0)/ 1-0 S(1) and H2 2-1 S(1)/1-0 S(1) line ratios in HD 97048 are consistent with H2 gas at T>2000 K and suggest that the emission observed may be produced by X-ray excitation. The upper limits for the line ratios for HD 100546 are inconclusive. Because the H2 emission is located at large radii, for both sources a thermal emission scenario (i.e., gas heated by collisions with dust) is implausible. We argue that the observation of H2 emission at large radii may be indicative of an extended disk atmosphere at radii >5 AU. This may be explained by a hydrostatic disk in which gas and dust are thermally decoupled or by a disk wind caused by photoevaporation.

Comments: Accepted by A&A. 16 pages, 7 figures
Subjects: **Solar and Stellar Astrophysics (astro-ph.SR)**
Cite as: **arXiv:1107.1994 [astro-ph.SR]**

Submission history

From: Carmona Andres [view email]

[v1] Mon, 11 Jul 2011 11:05:28 GMT (955kb,D)