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# **Revised chemistry of HD209458 b**

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We characterize the atmosphere of the iconic giant planet HD209458 b based on a joint modeling effort of the available observations.

HD 209458 b is the first planet with a reported detection of a chemical species in its atmosphere, namely Na I, and also the one with the largest number of reported species (H I, O I, C II, Mg I, Fe II, Ca I, Sc I, H<sub>2</sub>O, CO, HCN, CH<sub>4</sub>, C<sub>2</sub>H<sub>2</sub> and NH<sub>3</sub>). However, recent studies casted doubts on the authenticity of some detections. Most of the discrepant results are based on data obtained with different observing techniques, especially using low- and high-resolution spectroscopy. We performed a joint analysis of archive data to exploit the synergies between multiple observing techniques.

We reconciled discrepant results reported in the literature by identifying a range of planetary atmospheres that are consistent with both low- and high-resolution spectroscopic observations. The joint analysis enabled us to place tighter constraints on the chemical composition and physical state of the HD209458 b atmosphere. We discuss our findings providing an updated picture of this planetary system.