Insights into early star formation

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Merging beams of hydrogen atoms and hydrogen ions to create molecular hydrogen in the lab helps shed light on star assembly in the early universe, a U.S. and European research team reports in the July 2 issue of *Science*.

How the first stars emerged from the cosmic “dark age” that followed the big bang is a major question in astrophysics. The first stars began as hot clouds of primordial hydrogen and helium gas that cooled and condensed to form stars.

Collisions of positive and negative hydrogen ions, which spit out electrons in the process of forming hydrogen molecules (H_2), made up a key step in this cooling process.

Holger Kreckel and colleagues constructed an apparatus for carefully tuning the relative velocity of merged hydrogen atom and ion beams. They used it to perform precise measurements of the rate at which molecular hydrogen formed when the two beams merged, at a range of different energies.

The researchers plugged their measurements, which agreed with theoretical calculations, into cosmological simulations. The results refined their predictions for how massive the first stars likely were, reducing the uncertainty from a factor of more than 20 to a factor of approximately two.

In a related Perspective, Volker Bromm explains why knowing the

typical mass range of the first stars is important for understanding early cosmic evolution, and he writes that “it is a fascinating aspect of this study that microphysical processes can have such large-scale, cosmological implications.”

More information: "Experimental Results for H2 Formation from H– and H and Implications for First Star Formation," by H. Kreckel et al., Science, July 2, 2010.

Provided by AAAS