The dynamics of the bipolar HII region RCW 36 with SOFIA

Bonne, L.; García, P.; Schneider, N.; Simon, R.; Townsley, L.; Broos, P.; ... ; Tielens, A.G.G.M.

Bulletin of the AAS • Vol. 53, Issue 6

The Dynamics Of The Bipolar Hii Region RCW 36 With SOFIA

L. Bonne[1], P. García[2], N. Schneider[3], R. Simon[3], L. Townsley[4], P. Broos[4], J. Jackson[1], A. Tielens[5]

[1]SOFIA Science Center, USRA, Moffett Field, CA,

[2]National Astronomy Observatory of China, Santiago, Chile,

[3]I. Physik. Institut, University of Cologne, Cologne, Germany,

[4]Department of Astronomy & Astrophysics, 525 Davey Laboratory, Pennsylvania State University, University Park, PA,

[5]Leiden Observatory, Leiden University, Leiden, Netherlands; Department of Astronomy and Joint Space-Science Institute, University of Maryland, College Park, MD

Published on: Jun 18, 2021

The impact of stellar feedback on the evolution of the interstellar medium (ISM) plays a central role in galactic evolution as well as the star formation process at the molecular cloud and core scales. We present observations of the [CII] and [OI] fine-structure lines from the SOFIA FEEDBACK Legacy Survey towards the bipolar HII region RCW 36 in the Vela C molecular cloud, complemented with Chandra observations. RCW 36 is a prototypical bipolar HII region that consists of an OB cluster, with an estimated age of 1 Myr, at the center of a dense molecular ring and bipolar cavities. The SOFIA observations show [CII] and [OI] self-absorption in the dense molecular ring, and unveil blueshifted expanding shells in the cavities. Using this kinematic information, the expansion timescale for the ring and cavities can be estimated. The resulting expansion timescale for the cavities is significantly smaller than for the central ring, demonstrating that the expansion of RCW 36 proceeds in multiple stages. The observations further show that the stellar feedback locally breaks through the dense molecular ring and thus disrupts dense star forming gas. Lastly, the SOFIA observations unveil a powerful bipolar outflow in the cavities that is only detected in [CII]. The Chandra data demonstrates the presence of a hot plasma inside the ring and cavities that is excited by stellar winds from the OB cluster. This hot plasma also extends beyond the bipolar region, implying important leakage of the hot plasma from the HII region. This leakage provides an explanation for the relatively low expansion energetics of the ring and cavity. The combined data thus shows that stellar feedback drives inhomogeneous expansion that can simultaneously lead to the formation and disruption of dense star forming gas.