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A Chandra Observation of the Obscured Star-Forming Complex W40

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The young stellar cluster illuminating the W40 H II region, one of the nearest massive star forming regions, has been observed with the ACIS detector on board the Chandra X-ray Observatory. Due to its high obscuration, this is a poorly-studied stellar cluster with only a handful of bright stars visible in the optical band, including three OB stars identified as primary excitation sources. We detect 225 X-ray sources, of which 85% are confidently identified as young stellar members of the region. Two potential distances of the cluster, 260 pc and 600 pc, are used in the paper. Supposing the X-ray luminosity function to be universal, it supports a 600 pc distance as a lower limit for W40 and a total population of at least 600 stars down to 0.1 Mo under the assumption of a coeval population with a uniform obscuration. In fact, there is strong spatial variation in Ks-band-excess disk fraction and non-uniform obscuration due to a dust lane that is identified in absorption in optical, infrared and X-ray. The dust lane is likely part of a ring of material which includes the molecular core within W40. In contrast to the likely ongoing star formation in the dust lane, the molecular core is inactive. The star cluster has a spherical morphology, an isothermal sphere density profile, and mass segregation down to 1.5 Mo. However, other cluster properties, including a ≤ 1 Myr age estimate and ongoing star formation, indicate that the cluster is not dynamically relaxed. X-ray diffuse emission and a powerful flare from a young stellar object are also reported.

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