In a continuing effort to understand the nature of the metal carbon bond in transition metal monocarbides we have undertaken the first spectroscopic investigation of MoC by resonant two-photon ionization spectroscopy. Molybdenum carbide was produced by laser vaporization of a Mo sample disk in a supersonic expansion of He and 3% CH₄. Using 6.42 eV photons for photoionization we have observed a number of transitions between 17,700 cm⁻¹ and 24,000 cm⁻¹. Twenty four of the observed bands have been studied at sufficient resolution (0.04 cm⁻¹) to allow the rotational structure of each transition to be resolved. An analysis of the isotope shifts has allowed a tentative identification of three band systems among the 24 observed transitions. A number of the observed bands have remained ungrouped. Every rotationally resolved band appears to be an Ω = 1 ← 0 transition. Given that the ground state of NbCₐ is known to be 11σ²2δ¹ 2Δᵣ and that of RuCₐ' is known to be 11σ²2δ¹ 1Σ⁺, it seems likely that the addition of another electron on moving from NbC to MoC yields for a ground state the Ω = 0⁺ component of a 3Σ⁻ term. This is consistent with the observation that every transition in this study originates from an Ω = 0 state. The Xₐ³Σ⁻ rotational constant for the most abundant isotope, ⁹⁶Mo¹³C, has been determined to be 0.553640 ± 0.000055 cm⁻¹. This corresponds to a ground state bond length of 1.687719 ± 0.000084 Å.

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*b. Langenberg, R. S. Dabell, L. Shao, D. Dreessen, and M. D. Morse, in preparation."