

Star Formation in the Molecular Cloud Associated with the Monkey Head Nebula: Sequential or Spontaneous?

J. O. Chibueze¹, K. Imura¹, T. Omodaka¹, T. Handa¹, T. Nagayama²,
K. Fujisawa³, K. Sunada², M. Nakano⁴, T. Kamezaki¹, and
Y. Yamaguchi¹

¹Department of Physics and Astronomy, Graduate School of Science and Engineering,
Kagoshima University, 1-21-35 Korimoto, Kagoshima 890-0065, Japan
email: james@milkyway.sci.kagoshima-u.ac.jp

²Mizusawa VLBI Observatory, National Astronomical Observatory of Japan, 2-21-1 Osawa,
Mitaka, Tokyo 181-8588, Japan

³Department of Physics and Informatics, Faculty of Science, Yamaguchi University, Yoshida
1677-1, Yamaguchi 753-8512, Japan

⁴Faculty of Education and Welfare Science, Oita University, Oita 870-1192, Japan

Abstract. We mapped the NH₃ (1,1), (2,2), and (3,3) lines of the molecular cloud associated with the Monkey Head Nebula (MHN) with 1'.6 angular resolution using Kashima 34 m telescope. Its kinetic temperature distribution was contrary to what is expected for a molecular cloud at the edge of an expanding H II region and suggested that the massive star associated with S252A compact HII region formed spontaneously rather than through a sequential process.

Keywords. HII regions — ISM: clouds — ISM: molecules

1. Introduction

Massive star formation is yet a poorly understood concept in astronomy. Elmegreen & Lada (1977) proposed that massive stars in OB association form sequentially, triggered by the shock effect of an expanding H II region. To observationally verify the accuracy of this scenario, we studied the Gem OB1 cloud, a dense molecular cloud at the edge of an diffuse H II region (Monkey Head Nebula, MHN).

2. Observations and Results

We mapped the NH₃ (1,1), (2,2) and (3,3) lines of the dense molecular gas of Gem OB1 from which we estimated its mass and kinetic temperature distribution. We obtained both the virial and the LTE mass to be ~ 2000 solar masses. We expected higher temperatures at the interface between the hot ionized gas of the H II region and the molecular cloud, but on the contrary, temperature range 10 – 30 K was dominant in the entire region and > 50 K in the region near S252A. 8.4 GHz Yamaguchi 32m telescope observation of the ionized gas showed the true morphology to be similar to that of its optical image. Thus, the influence of the expanding H II region, MHN, is quite limited and the warmer gas is heated up by the S252A compact H II region. Comparing this with the infrared data, we concluded that the massive star of S252A formed spontaneously, not sequentially.

Reference

Elmegreen, B. G. & Lada, C. J. 1977, *ApJ*, 214, 725