UNIWERSYTET
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Album no.: 503321

DOCTORAL DISSERTATION ABSTRACT

Scientific discipline: **Astronomy**

Title of the doctoral dissertation: **Deriving the nature of the methanol masers in high-mass star-forming regions via multi-wavelength and polarimetric observations**

Doctoral dissertation abstract:

This work presents research on high-mass star formation via maser emission, particularly the 6.7 GHz methanol maser transition. The observations were made via high-resolution interferometric networks, for radio wavelengths via Very Long Baseline Array (VLBA), the European VLBI Network (EVN), and Multi-Element Remotely Linked Interferometer Network (MERLIN), and for millimeter wavelengths via Atacama Large Millimeter/submillimeter Array (ALMA). The publication I summarizes the maser flare for the three maser transitions (6.7, 12.2, and 22.2 GHz) in young high-mass stellar object. The detailed analysis of the distribution and morphology of maser cloudlets, as well as infrared and submillimeter counterparts, during the flare indicates a lack of episodic-accretion burst events and indicates the less energetic phenomena. The publication II focuses on the coincidence between 6.7 GHz methanol transition and 6.035 GHz exited OH transition in ten high-mass star formation regions to put constraints on physical conditions around young stars. We analyze the mutual alignment of these two masers, their infrared, radio continuum, and submillimeter counterparts, and then we discuss the age of the sources. The results show that coincidence of two maser transitions is associated mostly with the local changes of physical properties on the small scales, a few hundred au. We also estimated the strength and the orientation of the magnetic field using the 6.035 GHz exited OH transition. The results show that the typical values of magnetic field strength

are a few milligauss, and no relation between magnetic field orientation and the outflows. The publication III focuses on the magnetic field for two maser transitions (6.7 GHz methanol and 6.035 GHz OH). We attempted to determine which of the theoretical values of the splitting coefficient is dominant at the 6.7 GHz transition. As a result, we narrowed the choice of possible coefficients to three among eight. In the last chapter, we present the relation between thermal disc/shocks tracers and 6.7 GHz methanol maser emission in five high-mass star-forming regions where the ring-line morphology was derived at the 6.7 GHz line before. The ALMA data for the first time allow us to look directly into the environment of a forming high-mass star at a similar angular resolution as the VLBI observations of masers. Preliminary results indicate that the methanol masers do not relate to disks in all cases; more complicated/sophisticated scenarios must be considered.

Agnieszka Kobak
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doctoral student's signature