Study on absorption feature at 11.2 μm in spectra of young forming stars

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There is a feature at a wavelength around 11.2μm in absorption spectra of many astronomical objects, including forming stars, and the candidate for it is still debated. Possibilities include water ice, silicon carbide, PAHs or crystalline silicates, all of which are known and abundant constituents of cosmic dust. In this paper, we systematically investigate spectra of many young stellar objects – primarily obtained with Michelle and T-ReCs on Gemini-N and Gemini_S respectively – to find if there is a relationship between this feature and the one at 9.7μm, which is caused by amorphous silicates. The problem is approached with two methods, firstly comparing the observed optical depths at the two wavelengths and secondly modeling of a mixture of amorphous and crystalline silicates. In most of the objects, there is a weak correlation between the peak optical depths of the amorphous and possible crystalline silicates; meanwhile, our two-component models fit well with the observations. We conclude it is indeed crystalline silicates which exist in those objects, with an abundance of 2% to 8.5%, compared to that of amorphous silicate. Unless there is some remnant crystallinity of silicate dust in the interstellar medium, at odds with published upper limits, our observations suggest that the crystallization phase of silicate dust may occur much earlier than currently thought.