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Institutsseminar

Astrochemical history of carbon

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Dying stars produce carbon which is then delivered into the interstellar medium (ISM). This carbon is atomized in the ISM by supernova explosions. In the next step, it converts into molecules and solids at low temperatures of the ISM. These solids are building blocks for the formation of planetary systems. The presentation aims to give an overview of recent experimental and computational studies on such gas-to-solid-state transition of carbon. This transition leads to the formation of a vast number of organic and biologically relevant molecules, such as peptides. Interestingly, this peptide formation skips the stage of amino acid formation and proceeds via a novel pathway. The pathway of peptide formation was confirmed using ^{13}C, which showed that peptide formation occurs through the polymerization of aminoketene molecules that are formed in the C + CO + NH_3 reaction. Although water slightly reduces the efficiency of aminoketene polymerization, it does not prevent the formation of peptides. The time given for the reactions to occur plays a significant role in peptide formation, with longer reaction times resulting in longer peptides, which could be essential considering astronomical timescales.

During the presentation, a new experimental setup will be introduced, which is currently being constructed at MPIA in Heidelberg. This setup will combine two experimental approaches that are currently used to investigate low-temperature reactions of carbon. The ice machine and He droplet beam machine will be merged into a single setup, which will provide a synergistic approach to the investigation of low-temperature surface reactions. This new setup will specifically enable the exploration of ion-molecule surface reactions, which remain terra incognita in astrochemistry.