Machine learning in the study of the first galaxies

In a collaboration between CIM and astronomers at the Department of Physics and Astronomy, machine learning takes the stage as a powerful tool in the interpretation of data on the first generations of galaxies.

In 2018, the James Webb Space Telescope – the largest telescope ever launched into space – is expected to revolutionize our view of the early Universe. Astronomers across the world are already busy planning observations and sharpening their analysis tools in anticipation of the data. In a recent paper, Hannes Jensen and collaborators at Uppsala University argue that machine learning techniques applied to the analysis of light spectra obtained with the James Webb Space Telescope may help crack one of the great unsolved problems of modern cosmology – the puzzle of cosmic re-ionization.

After the Big Bang, the Universe expanded and cooled off, eventually allowing neutral hydrogen atoms to form. The puzzle is that most of the hydrogen in the present-day Universe appears to be highly ionized. Hence, the Universe must at some point have undergone re-ionization on cosmic scales. Astronomers already know that this happened less than one billion years after the Big Bang, but not what the actual cause was. The most likely scenario is that energetic photons from hot, young stars in the first generation of galaxies flooded the Universe and re-ionized the neutral gas. But so far, nobody has been able to demonstrate that this is what really happened. The ongoing collaboration between CIM staff and astronomers has resulted in new analysis methods that can be applied as soon as the James Webb Space Telescope starts delivering data, and will for the first time allow a measurement of the fraction of ionizing radiation that escape from the galaxies in the early Universe.

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