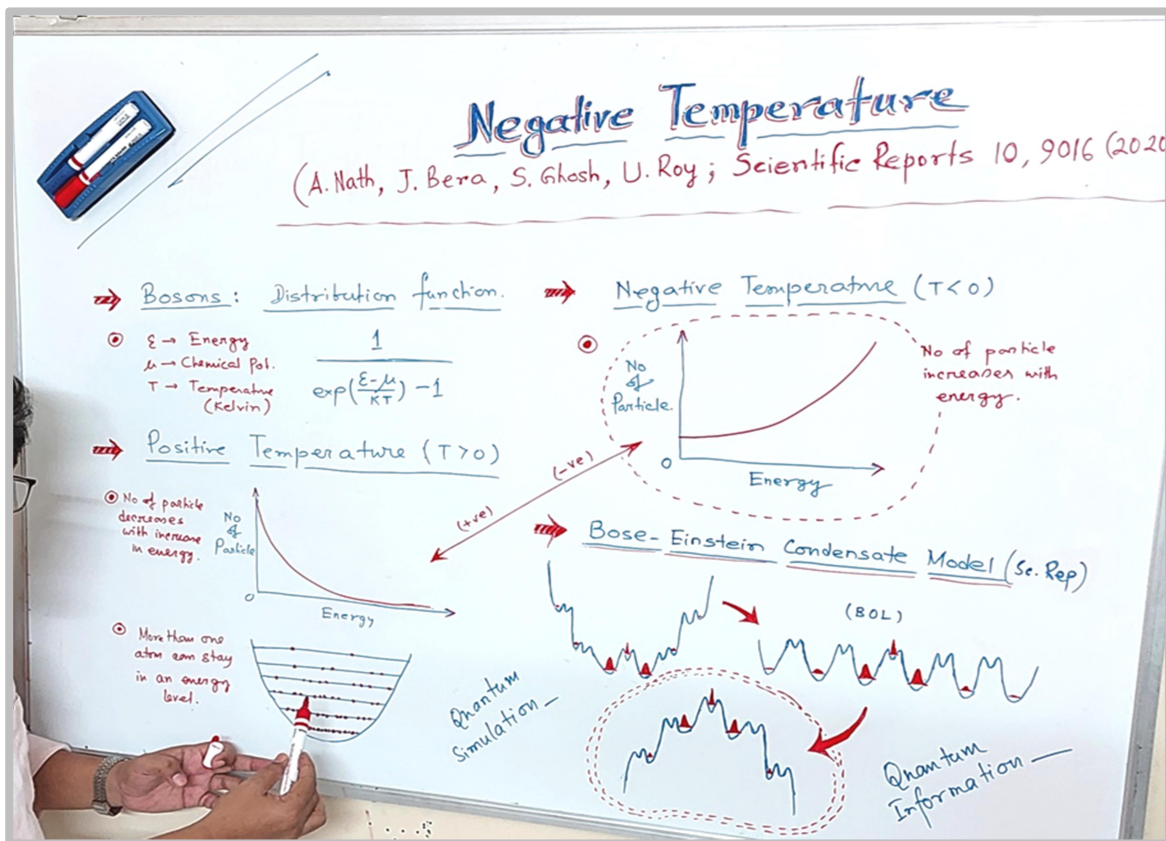


First exact model for “Negative Absolute Temperature” ($< 0^{\circ} \text{K}$)

In a recently published paper in June, 2020, the research group led by Prof. Utpal Roy, Department of Physics, Indian Institute of Technology Patna, Bihar, has invented an exact method to produce Negative Absolute Temperature in a system of Ultracold-atoms or Bose-Einstein condensate (BEC). They have published their work in a reputed International journal, ‘Scientific Reports’, of Springer Nature publication with fully waived APC (A. Nath, J. Bera, S. Ghosh and U. Roy, *Sci. Rep* 10, 9016 (2020). <https://doi.org/10.1038/s41598-020-65765-9>).



Temperature is a very important quantity in most of the aspects of our daily life. It is related to the hot or cold and a manifestation of energy of a matter. Temperature is measured with thermometer, which is calibrated in various temperature scales, such as Celsius, Fahrenheit, Kelvin, etc. Everywhere we deal with a positive temperature-scale only. An interesting question existed, whether there is a matter in

reality for which a *negative Absolute temperature*-scale is required. The answer is now 'YES'. Negative temperature state is known as the 'hotter than the hottest'.

In reality, nobody in the world was aware of any Negative temperature-scale until its first practical existence in BEC (*Science* 339, 52–55, 2013). Since then scientists all over the world have been trying to get more insight into the physics of negative temperature.

BEC is called the fifth-state of matter, which appears near absolute zero temperature ($<\mu\text{K}$) and routinely created in laboratory. This quantum-matter has already become a very promising candidate for paving efficient future quantum technology. A couple of days back; it is also reported in the Earth-orbiting research lab in the space station by NASA.

The group led by Prof. Roy has discovered an exact scheme for getting maximum negative temperature for ultracold atoms. This discovery is quite enriching for future quantum technology in BEC. They have used BEC inside an expulsive bichromatic optical lattice and created an equilibrium state of ultracold atoms at higher energy. Their discovery imparts the scheme for most negative temperature in any physical system to date. Their state can be popularly called as "The hottest ultracold atoms".

For more details, please go to the publication link:
<https://doi.org/10.1038/s41598-020-65765-9>