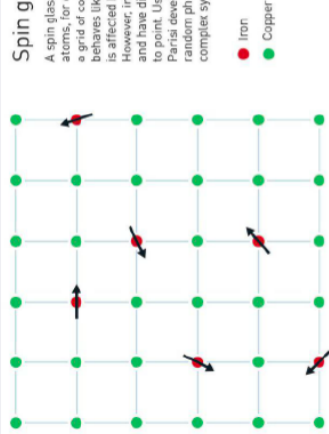


6/10/2021: THE HINDU

### Spin glass

A spin glass is a metal alloy where iron atoms, for example, are randomly mixed into a grid of copper atoms. Each iron atom behaves like a small magnet, or spin, which is affected by the other magnets around it. However, in a spin glass they are frustrated and have difficulty choosing which direction to point. Using his studies of spin glass, Parisi developed a theory of disordered and random phenomena that covers many other complex systems.



© Johan Jarnestad/The Royal Swedish Academy of Sciences

Syukuro Manabe and Klaus Hasselmann have been jointly awarded one half of prize the “for the physical modelling of Earth’s climate, quantifying variability and reliably predicting global warming.”

Giorgio Parisi has been awarded the other half “for the discovery of the interplay of disorder and fluctuations in physical systems from atomic to planetary scales.”

Manabe is of US and Japanese origin, Klaus Hasselmann hails from Germany while Parisi is from Italy.

The prestigious award comes with a gold medal and 10 million Swedish kronor (over \$1.4 million). The prize money comes from a bequest left by the prize’s creator, Swedish inventor Alfred Nobel, who died in 1895.

## Climate experts, theorist get Physics Nobel

AGENCE FRANCE-PRESSE STOCKHOLM

U.S.-Japanese scientist Syukuro Manabe, Klaus Hasselmann of Germany and Giorgio Parisi of Italy on Tuesday won the Nobel Physics Prize for climate models and the understanding of physical systems, the jury said.

The Nobel committee said it was sending a message with its prize announcement just weeks before the COP26 climate summit in Glasgow. “What we are saying is that the modelling of climate is solidly based in physics theory,” said chair of the Nobel Committee for Physics Thor Hau

Hansson. Dr. Manabe, 90, and Dr. Hasselmann, 89, share one half of the 10 million kronor (\$1.1 million) prize for their research on climate models, while Dr. Parisi, 73, won the other half for his work on the interplay of disorder and fluctuations in physical systems.

### Details

### NOBEL PRIZE IN PHYSICS

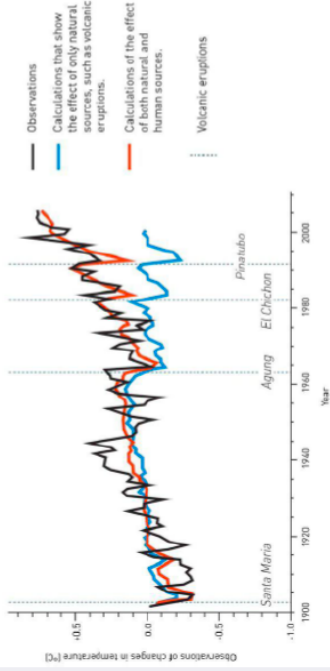
### About

The 2021 Nobel Prize for physics has been awarded jointly to Syukuro Manabe, Klaus Hasselmann and Giorgio Parisi “for groundbreaking contributions to our understanding of complex physical systems.”

This year’s Physics Nobel recognises new methods for describing complex systems and predicting their long-term behaviour. One complex system of vital importance to humankind is Earth’s climate

### Identifying fingerprints in the climate

Klaus Hasselmann developed methods for distinguishing between natural and human-induced changes in the mean temperature in relation to the average for 1901–1950 [°C].

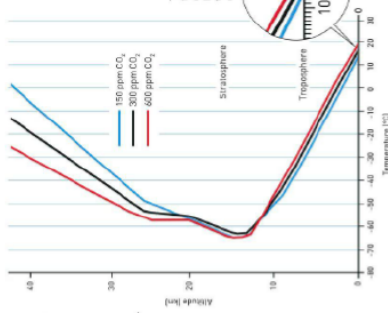


Source: Hegerl and Zwiers (2011) Use of models to detect and attribute climate change. WIREs, Climate Change.

© Johan Jarnestad/The Royal Swedish Academy of Sciences

### Carbon dioxide heats the atmosphere

Increased levels of carbon dioxide lead to higher temperatures in the lower atmosphere, while the upper atmosphere gets colder. The variation in temperature is due to increased levels of carbon dioxide. If we increase the concentration of carbon dioxide, the entire atmosphere should have warmed up.



Source: Manabe and Stouffer (1993) The greenhouse effect: a numerical climate model. Journal of atmospheric sciences, Vol. 50, No. 10, p. 1304

© Johan Jarnestad/The Royal Swedish Academy of Sciences