

ADRIAAN VAN BALLEGOOIJEN LECTURE:

Interwoven Paths and Tangled Fields:
Understanding the Sun
from Multiple Points of View

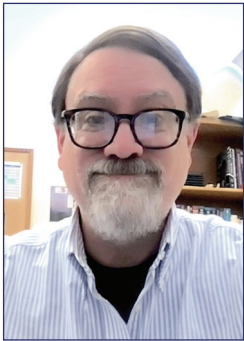
October 28, 2025

1:30 PM - 2:30 PM

Phillips Auditorium

CENTER FOR **ASTROPHYSICS**

HARVARD & SMITHSONIAN



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The Sun's outer atmosphere is heated to temperatures greater than a million degrees, and solar plasma expands into the heliosphere at supersonic speeds. This complex and unpredictable system varies over many orders of magnitude in space and time, so it's not surprising that we still do not have a complete theoretical understanding of it. However, since 1982, the year Aad van Ballegooijen defended his PhD in Utrecht, solar physics has made tremendous strides in observations, theory, and computer simulation. This presentation will review how all three of those methods have helped us answer some big questions about the Sun over the past four decades. Of course, I will enjoy sharing specific examples of how Aad's work was key to answering these questions. I hope to also say something about how we can draw lessons about doing great science from Aad's multidisciplinary approaches. Thus, we will view some new results from DKIST, Parker Solar Probe, and Solar Orbiter through some slightly tinted lenses and see how they're starting to fill in the remaining gaps in our understanding. Lastly, I don't want to let this day go by without mentioning some of Aad's not-so-well-known (and/or unpublished) accomplishments, such as a concept for calcite-crystal-based spectroscopy, a theory of extragalactic jets, and a space-weather forecasting tool that still has the chance to improve upon the ones in use today.

Aad van Ballegooijen's research was devoted to understanding the role of magnetic fields in the structure and stability of filaments and prominences. His work demonstrated the central role that flux rope structures have in the storage and release of energy in the solar corona. At the heart of his approach was an intimate connection between observations and simulation. A theoretician who made himself an expert in state-of-the-art observations, he opened up a new approach to modeling complex active region and global scale filament magnetic fields. He worked with a number of graduate students and postdocs in the US, UK, China and South America and made a huge impact on the theory and modeling community. After he formally retired, Aad continued to collaborate, guide, and inspire solar physicists.

Another of his major contributions was studying the role of magnetic braiding and MHD wave dynamics in the heating and acceleration of the Sun's outer atmosphere and solar wind. In the coronal loops, Aad's simulations demonstrated that waves traveling in both directions along loops would interact to produce turbulence, converting their energy into heat. In the open field, Aad simulated the heating and acceleration of the solar wind flowing from the magnetically open corona. Aad's sophisticated approach to MHD modeling included the upward propagating waves that are reflected downward to get the interactions required for turbulent heating. He modeled these interactions in great detail and showed for the first time that density fluctuations could enhance the turbulent heating in the solar wind.

AAD VAN BALLEGOOIJEN



The Adriaan van Ballegooijen Annual Lecture is hosted in memory of the former SAO scientist. Guest Lecturers are chosen by the CfA Colloquium Committee, with an emphasis on solar physicists. The endowment is funded by members of the Van Ballegooijen family.

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