THE ATMOSPHERES OF URANUS AND NEPTUNE. J. W. Norwood, New Mexico State University (Dept. of Astronomy, Box 30001/MSC 4500, Las Cruces, NM 88003-0001; jnorwood@nmsu.edu).

Many people's mental images of Uranus and Neptune are those from the Voyager 2 flybys: Uranus as a featureless cyan cueball, and Neptune a deep blue world boasting a Great Dark Spot. While we haven't made return visits to these planets, numerous technological advances have improved the way we study them from afar. Our understanding of Uranus and Neptune has greatly changed over the past couple decades.

As an example, since the Voyager era Uranus and Neptune have been extensively studied in the near-infrared. In this spectral region these planets’ occluding photochemical haze is transparent, allowing astronomers to study the different cloud layers beneath. The variable near-IR opacity of methane allows observations to probe to a wide range of depths in the tropospheres of the ice giants. Observations from the Hubble Space Telescope and from ground-based observatories with adaptive optics have enabled studies of variations across the disks of these planets. Improvements in quantifying methane’s opacity over long path lengths have improved the accuracy of our interpretations of these observations.

We also benefit from a longer temporal baseline of observations, which have granted us a broader view of changing weather patterns on these planets as well as a greater understanding of their (lengthy) seasonal cycles. As Uranus has progressed from its Voyager-era solstice to equinox in 2007 and beyond, we have witnessed an increase in storm activity, changes in chemical abundances, and the formation of a new “collar” of bright clouds forming around the pole entering sunlight, and the autumn pole’s clouds disappearing. On Neptune there have been storm features appearing and dissipating (including the disappearance of the Great Dark Spot), in addition to other subtler seasonal changes.

This talk will highlight the sources we have for the conclusions presented, including specifying which properties have been investigated recently, and which are still reliant upon Voyager data. Lastly and perhaps most importantly, this talk will identify several of the key questions that remain in our understanding of the atmospheres of the ice giants.

This review presentation will cover the state of our knowledge regarding the atmospheres of Uranus and Neptune, from the thermospheres to the deepest cloud layers. Among the topics discussed will be the chemical abundances in these planets’ atmospheres (and the implications of any departures from equilibrium or differing enhancements above solar), properties of these planets’ stratospheric haze layer and multiple cloud layers (composition, thickness, variability), and how these aspects vary both from pole to pole and with the changing seasons. Dynamics will also be covered, including zonal winds, the formation and morphology of storms, and our best understanding of global circulation on these planets.