Waves and Turbulence

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Members of the Working Group

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- T. Carter, UCLA
- S. Cranmer, Harvard CFA
- P. Diamond, UCSD
- W. Dorland, U. Maryland
- P. Goldreich, IAS and Caltech
- J. Kasper, Harvard CFA
- W. Matthaeus, U. Delaware
- M. Velli, JPL

Also, input from:
G. Hammett
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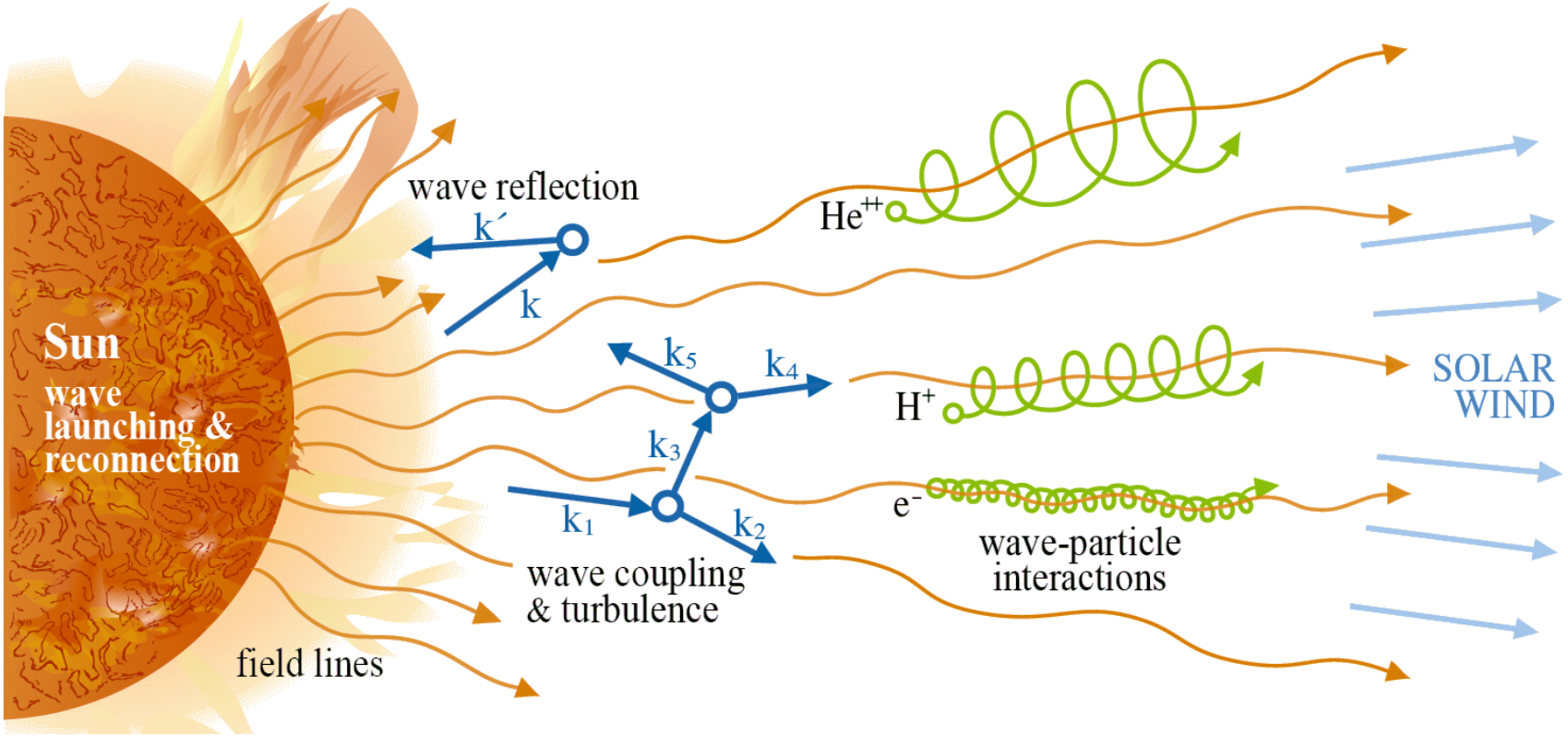
Some perspectives

- Like hydrodynamic turbulence, plasma turbulence is one of the most important, unsolved problems of classical physics, and has significant implications for nearly every topic in this Workshop.
- A cursory search on NASA ADS with the key words---*plasma waves and turbulence*, *space plasmas*, *astrophysical plasmas*---produced 1,488, 226 citations, not to mention the many books/monographs that discuss this subject.
- The only "theory of turbulence" that appears to enjoy near-universal acceptance is Kolmogorov (1941)---for hydrodynamic turbulence.

Our strategy

- Identify five important topics.
- Focus on some key questions that can be potentially transformational.
- Emphasis is on plasma processes, and "object integration" is primarily focused on one object---the solar wind---about which we know the most, and to a lesser extent, on the ISM. (Many other interesting objects, each of which can be the subject of a separate Workshop, have been omitted.)

Example: Kinetic dissipation processes in the solar corona



Courtesy: B. Chandran, M. Lee, and K. Donahue, UNH

Five topics

- Nature and properties of turbulent cascades
- Dissipation mechanisms and particle acceleration and heating
- Turbulence in inhomogeneous plasmas and interactions with mean fields
- Coherent structures in turbulence
- Role of laboratory experiments and observations

These topics are overlapping, and synergistic.

Four presentations

- *S. Boldyrev*: Nature and properties of turbulent cascades
- *W. Matthaeus*: Dissipation, particle acceleration and heating, and role of coherent structures
- *T. Carter*: Turbulence in inhomogeneous plasmas and role of laboratory experiments
- *A. Bhattacharjee*: Summary and connection with other topics in this Workshop.