SOL and Divertor Physics

SOL and Divertor Physics Introduction

- **We need models we can trust to design a DEMO divertor and PFC solution**
  - We can't scale existing experiments due to coupled dimensional (atomic physics) and dimensionless (plasma physics) processes
- **A two pronged approach is required for a validated solution**
  - The dominant processes embodied in numerical models validated in the relevant physics regime
  - Efficacy of divertor design concepts tested in appropriate regime
- **SOL physics with the greatest uncertainty in our models**
  - Turbulent transport (few contributions at this meeting)
  - Core coupling constraints (few contributions at this meeting)
  - Particle sources and sinks and transport between them
  - 3D effects
  - Others?

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- **Particle balance and transport has important implications**
  - SOL divertor heat flux dissipation and control
  - Helium and impurity control
  - PFC and main chamber erosion
- **Particle balance is difficult due to multiple processes**
  - Ionization, recombination (plasma and target), parallel flows, ExB drifts, turbulent transport, etc.
  - Lack of analytic models to guide our intuition and design
- **Experimental validation is also difficult**
  - Challenging diagnostic interpretation, 2D and 3D variations
  - Multiple processes required for validation

SOL and Divertor Physics Introduction

- **Outline of today's SOL Physics Session**
  - N. Rivals; Plasma-neutral interaction processes in modeling with SOLEDGE-3X
  - M. Umansky; Modeling dynamic wall recycling
  - C. Theiler; Alternative divertor geometries in TCV
  - J. Yu; Double null divertor studies
  - K. Thierry; Particle control in Stellerators (W7X)
  - V. Winters; Impurity transport in Stellerators (W7X)