Impressions from the mini-workshop:
"Nuclear Reactions in Type I X-ray Bursts"
Held at the Institute for Nuclear Theory, Seattle, as part of a larger workshop entitled: "The Neutron Star Crust and Surface".

Ed Brown (MSU) "The Connection Between Bursts and Crusts".

Ed is interested in the "feedback" from the crust, composed of post-burst ashes, to the next burst itself. Less than 1% of material is ejected from the burst, which occurs at the base of the accreting envelope. Material would have to mix to the surface to be ejected. The crust is a few % of the total neutron star mass.
Products of the burst appear to be a mass peak at A=100, from the Sn-Sb-Te cycle. The crust is at a radius of ~10.8 km. A few hundred meters down from this, free nucleons cease to exist.
In the crust, electron captures are forced, due to the electron Fermi energy being larger than the mass difference between nuclei. These captures start of in the A=100 region and move down to the drip-line over a characteristic timescale of 1000 years. The path then moves to lower masses by electron capture plus neutron decay, and reactions can carry the flow back up again.
Structure effects, ie. Including excited states for the electron captures to run to, effects how much heat is deposited in the crust. If you do not include excited states, not much heat deposition takes place. The excited state properties are estimated from Moller's liquid drop model.
There is over an order of magnitude difference in the x-ray burst recurrence timescale depending on the crust temperature. Ideally, 0.3MeV/u heating in the outer crust is needed to suit observation.

Andrew Cumming (McGill) "The role of the rp-process in accreting neutron stars".

Questions: What is the neutron star's spin and magnetic field? How are the binary systems made? What role does fluid dynamics play? What role do nuclear reactions play?
Energetics → Global Bursting behavior.
Duration → Lightcurves (long tails from rp-process).
→ Ashes → Superbursts (ashes re-ignite).
→ Crust transport and mechanical properties

Define parameter $\alpha = \frac{\int L_{acc} dt}{E_{burst}} = \frac{GM/R}{E_{nuc}} \approx \frac{200\,MeV}{(1-5)\,MeV}$
Reactions which play a role: 14O(a,p)17F(p,g)18Ne(a,p)21Na
Reactions which suggest double-peak structure in lightcurve: 30S(a,p)33Cl, 35Ar(a,p)37K

Over many bursts there is evidence that more and more nuclear energy is liberated (measure background under burst peaks wrt peaks themselves)

Sometimes burst doublets or triplets appear, separated by ten minutes, on a main burst periodicity of a few hours – not yet understood, thought to be linked to hydrogen ignition. But very consistently ten minutes apart. What waiting point (beta+ decay) could this be related to? Ten minutes is the observed (red-shifted) timescale.

Object EXO0748-676 has an amazingly perfect 50 second exponential decay, why? Nuclear?

Only 1-zone models have been used for sensitivity studies on waiting-point nuclei.

Randall Cooper (Harvard) "Nuclear Reactions During the Onset of Type-I X-Ray Bursts".

Severe discrepancies between theory and observation.

Theory	**Observation**
Bursts at all accretion rates up to the Eddington rate.	Only bursts above 30%. Eddington
Long burst durations.	Short burst durations.
Burst rate increases with accretion rate.	Burst rate decreases with accretion rate.
Little stable burning.	Lots stable burning.
No 12C for superbursts.	Superbursts observed.

All related to burst onset.

Hydrogen burning from the CNO cycle generates alpha particles for the 3-alpha reaction, which in turn generates 12C for the CNO cycle.
14O(a,p)17F(p,g)18Ne(a,p) all needed.
15O(a,g)19Ne(p,g) **need** this to break-out.
14O(a,p) cannot go without "push" from 15O(a,g).

There is no simple scaling of 15O(a,g) that reproduces the burst rates over an entire range of accretion rates.