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Noncrossing partitions and the shard intersection order.

I will discuss the shard intersection order $(W, \preceq)$ on a finite Coxeter group W. This poset is a lattice and has the noncrossing partition lattice $\mathrm{NC}(W)$ as a sublattice. This new construction of $\mathrm{NC}(W)$ yields a new proof that $\mathrm{NC}(W)$ is a lattice. The shard intersection order is graded and atomic. Its rank generating function is the W-Eulerian polynomial. Many order-theoretic properties of $(W, \preceq)$, like Möbius number, number of maximal chains, etc., are analogous to corresponding properties of $\mathrm{NC}(W)$.

The shard intersection order is most naturally defined in terms of the polyhedral geometry of the reflecting hyperplanes of W, and in particular certain codimension-1 polyhedral cones called shards. The reflecting hyperplanes are cut into shards according to a simple rule. Shards were originally defined as a way of understanding lattice congruences of the weak order on W. The collection of arbitrary intersections of shards forms a lattice under reverse containment. Arbitrary intersections of shards are in bijection with elements of W, so the lattice of shard intersections defines a partial order "$\preceq$" on W. I will illustrate the definitions and results with a running example, taking W to be the symmetric group S_4. (Received February 02, 2009)