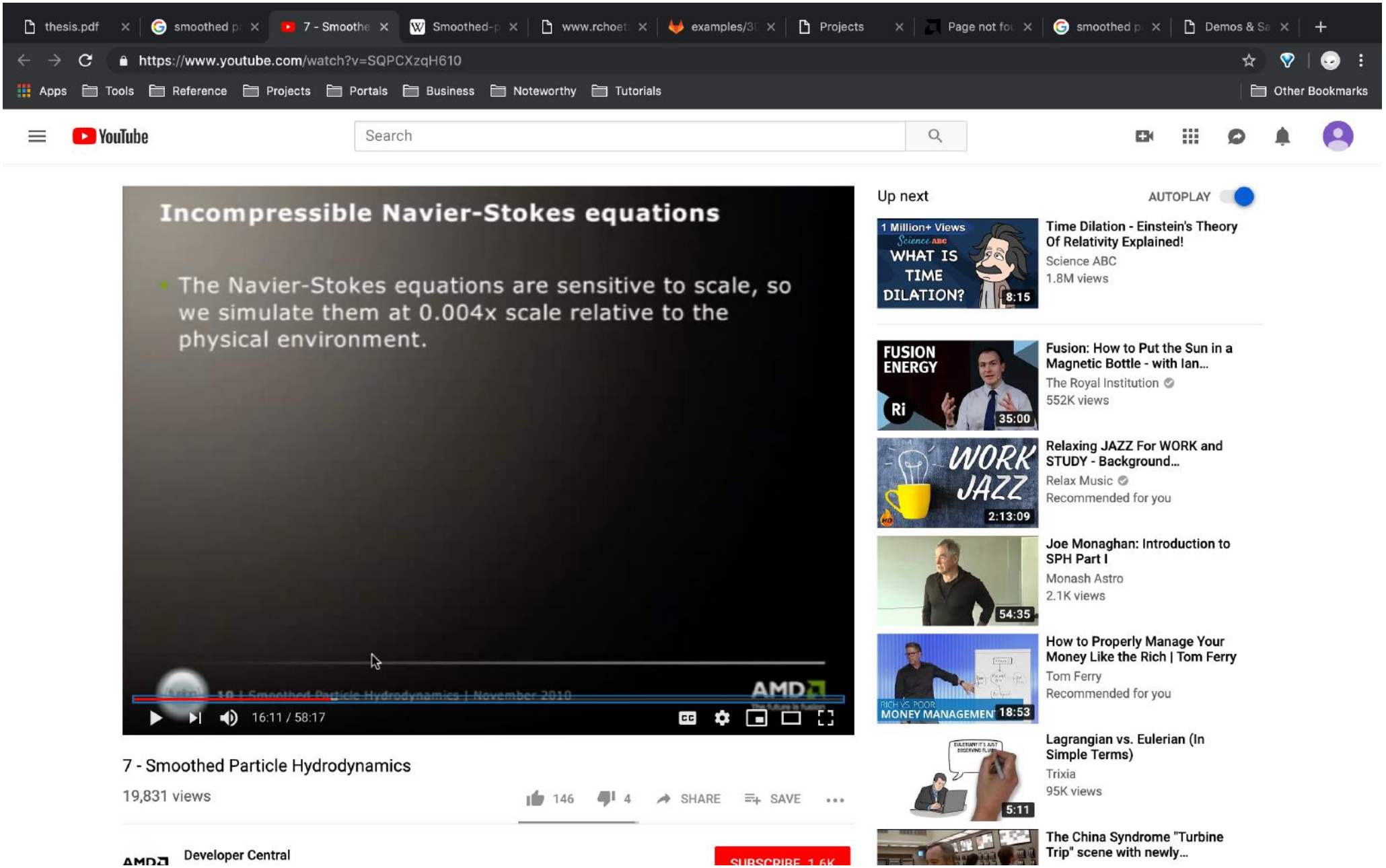
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The Navier-Stokes equations are sensitive to scale, so we simulate them at 0.004x scale relative to the physical environment.
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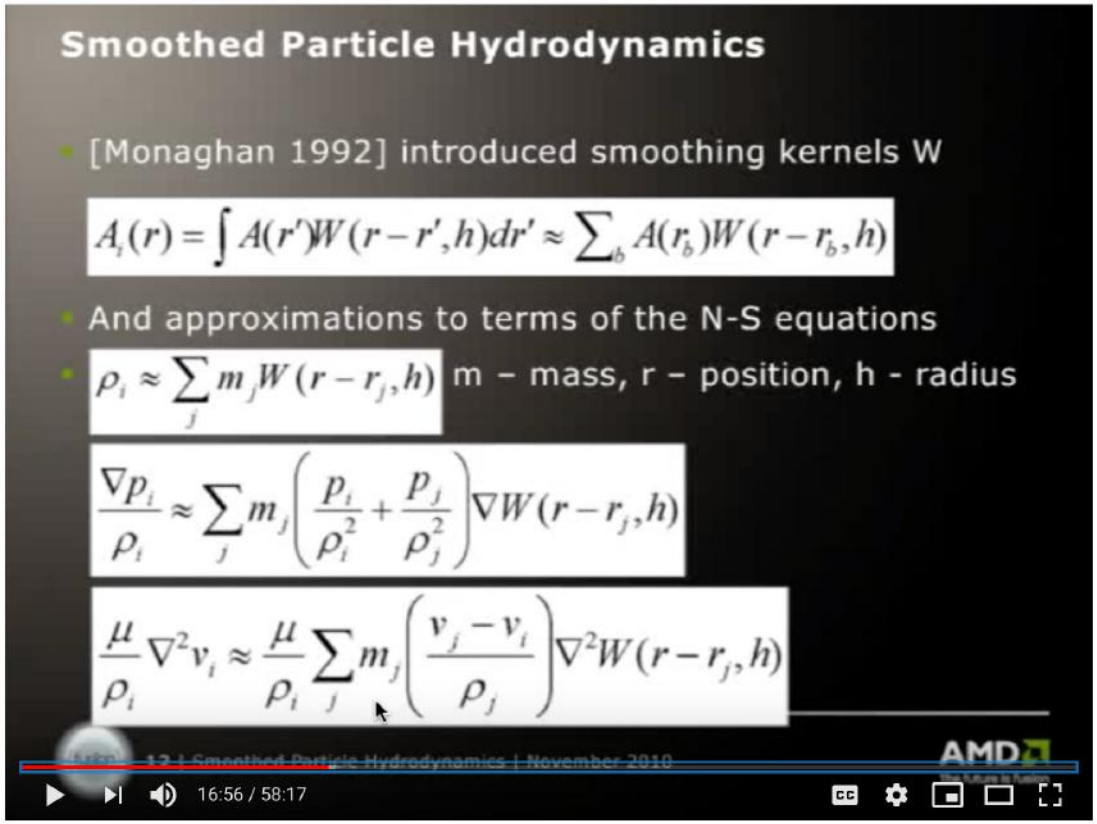


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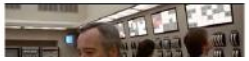

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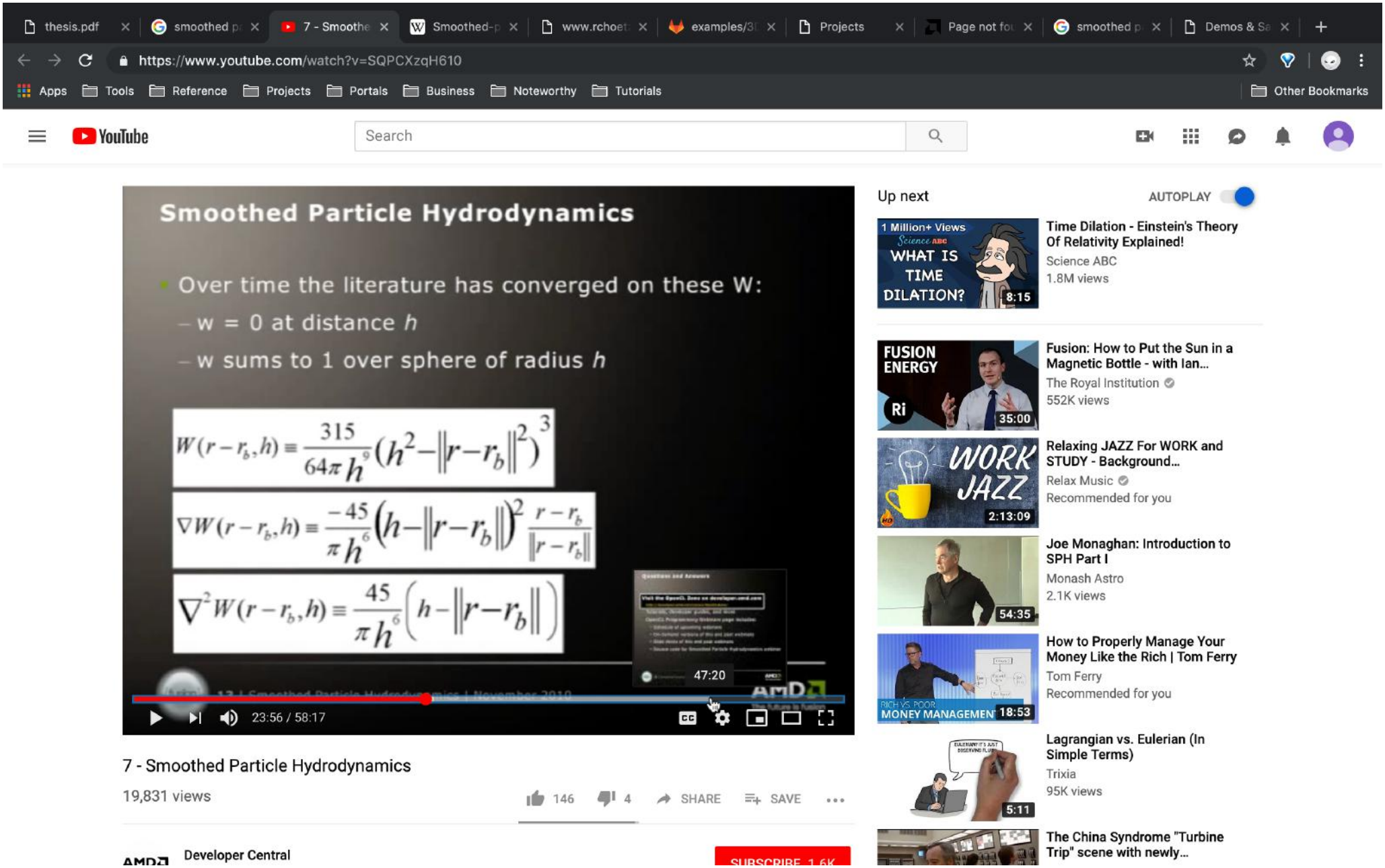
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Over time the literature has converged on these W:
w = 0 at distance h
w sums to 1 over sphere of radius h
$W(r-r_b,h) \equiv \frac{315}{64\pi h^9}(h^2-\|r-r_b\|^2)^3$
$\nabla W(r-r_b,h) \equiv \frac{-45}{\pi h^6}(h-\|r-r_b\|)^2 \frac{r-r_b}{\|r-r_b\|}$
$\nabla^2 W(r-r_b,h) \equiv \frac{45}{\pi h^6}(h-\|r-r_b\|)$
47:20
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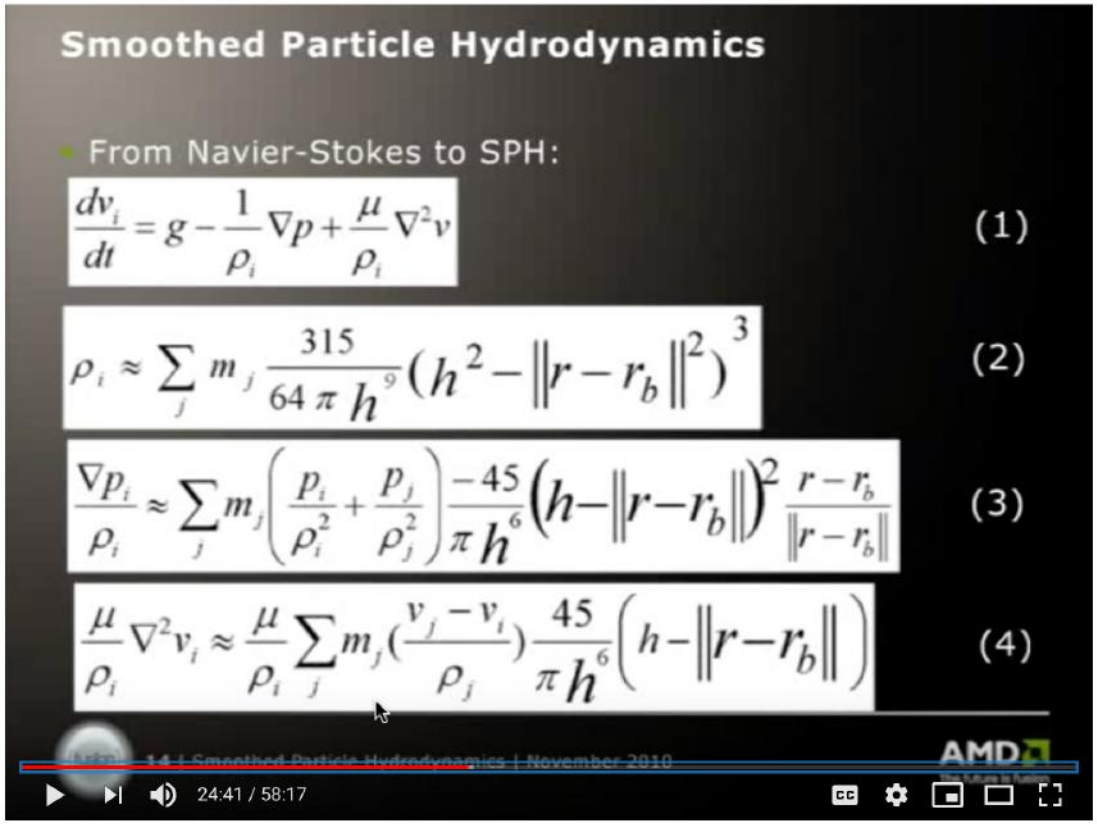


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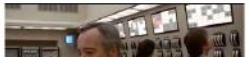

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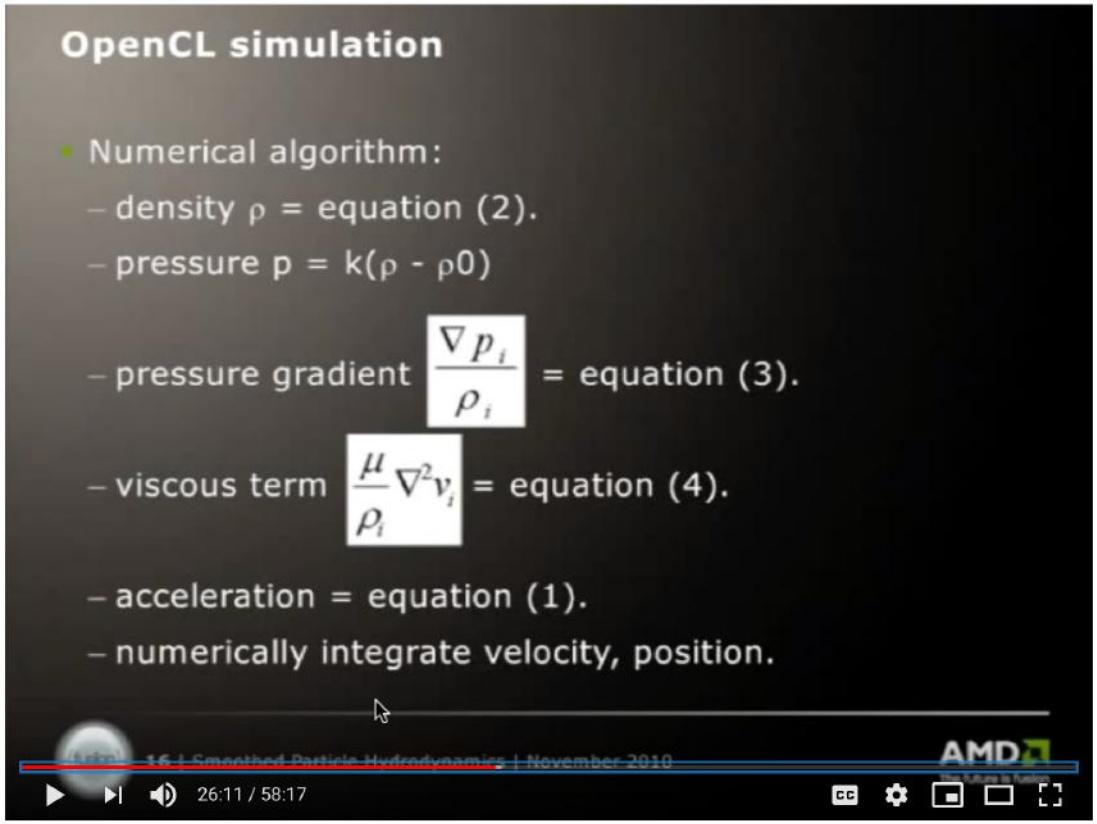


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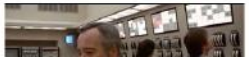

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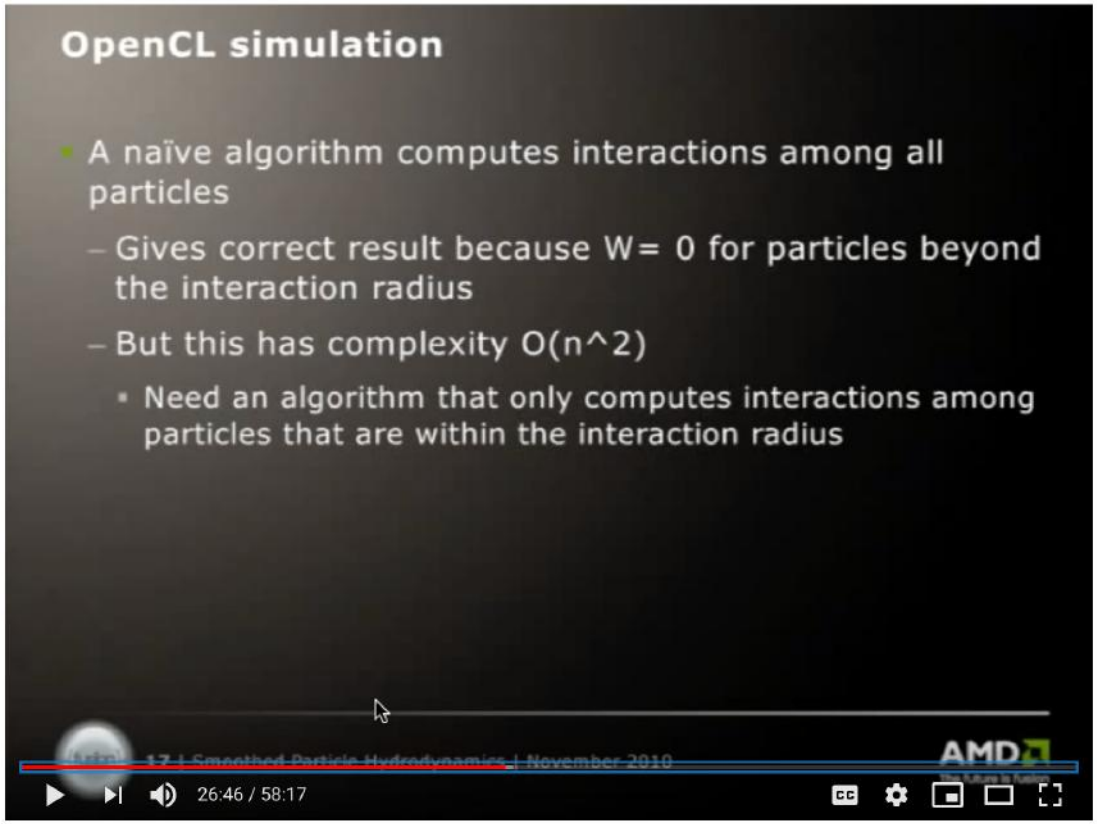


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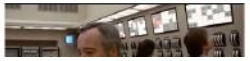

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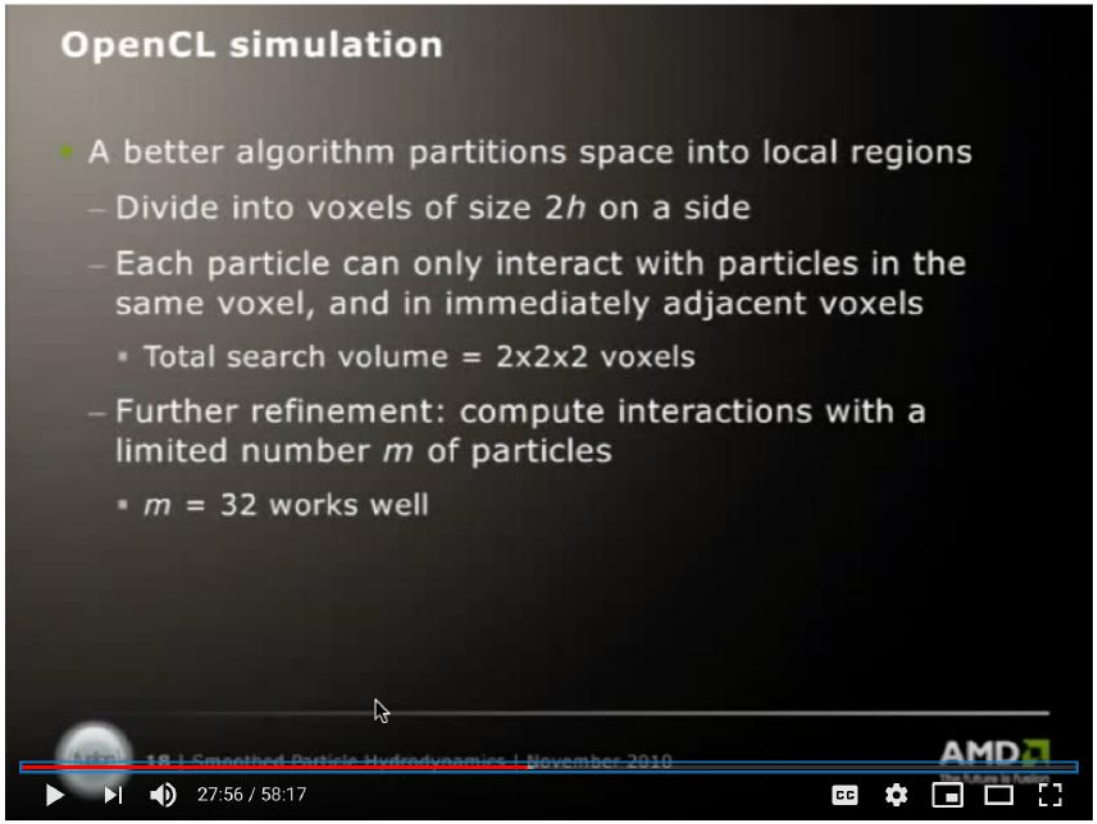


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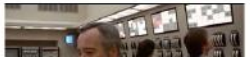

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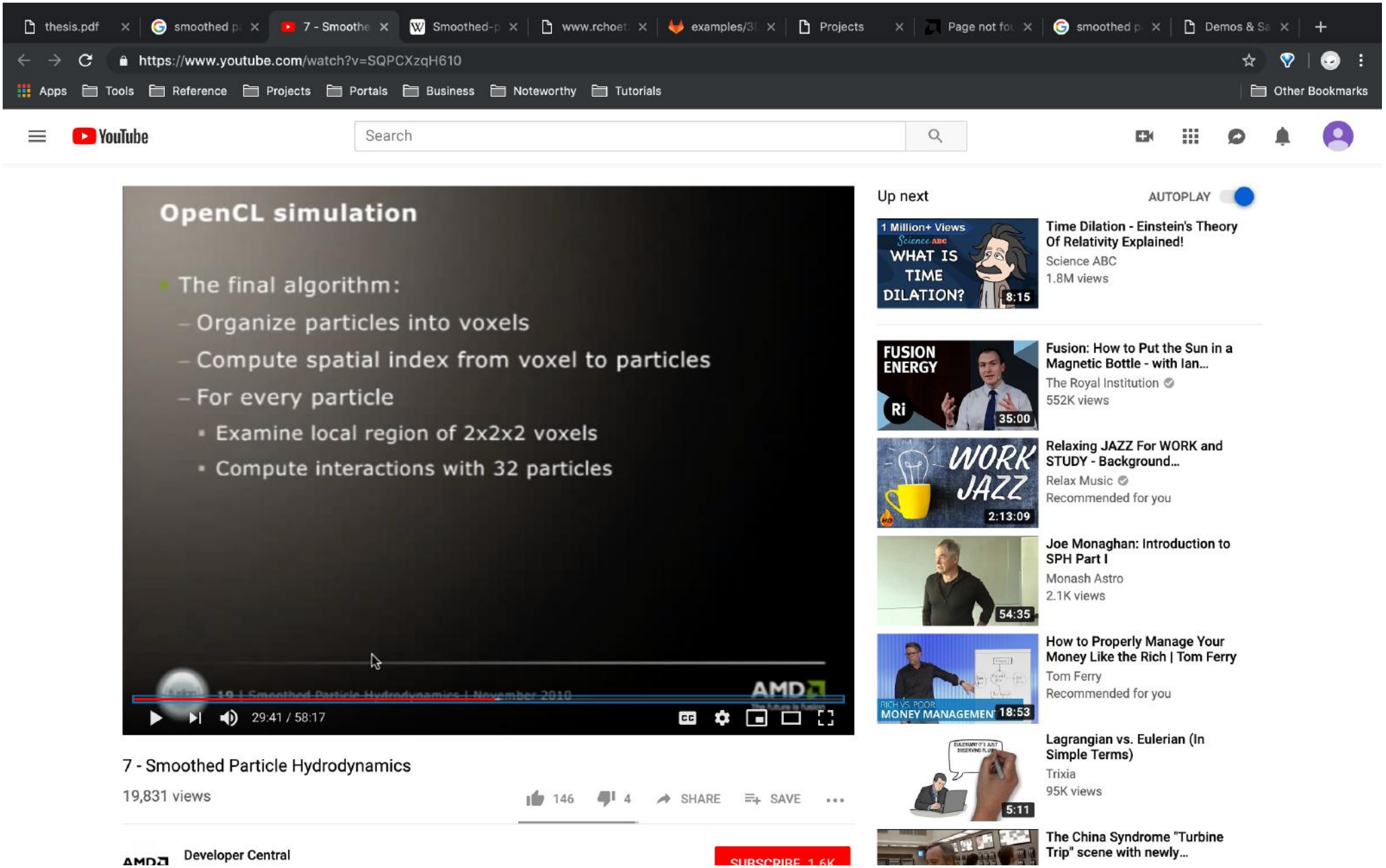
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The final algorithm:
– Organize particles into voxels
– Compute spatial index from voxel to particles
– For every particle
▪ Examine local region of 2x2x2 voxels
▪ Compute interactions with 32 particles
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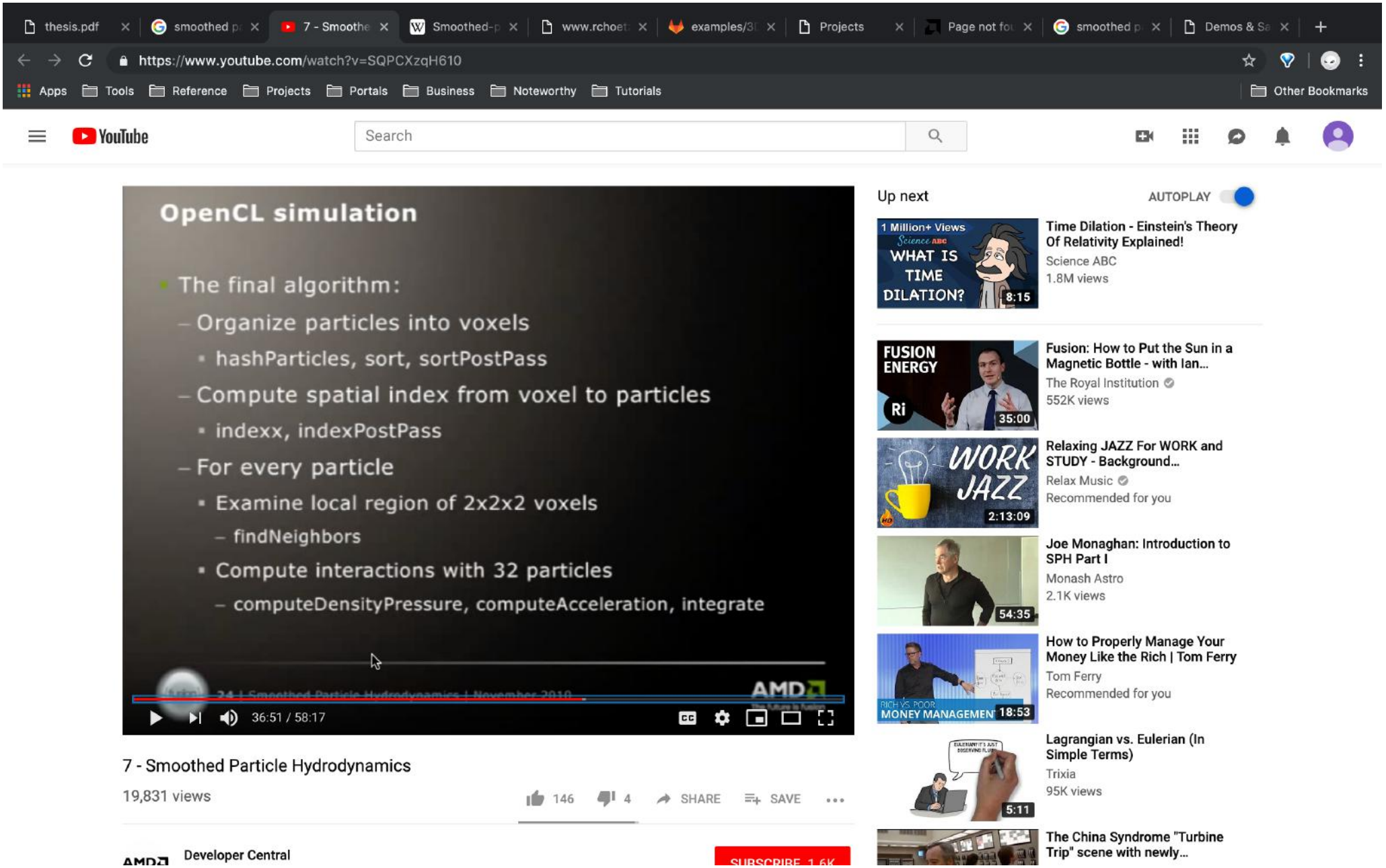
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Organize particles into voxels
hashParticles, sort, sortPostPass
Compute spatial index from voxel to particles
indexx, indexPostPass
For every particle
Examine local region of 2x2x2 voxels
findNeighbors
Compute interactions with 32 particles
computeDensityPressure, computeAcceleration, integrate
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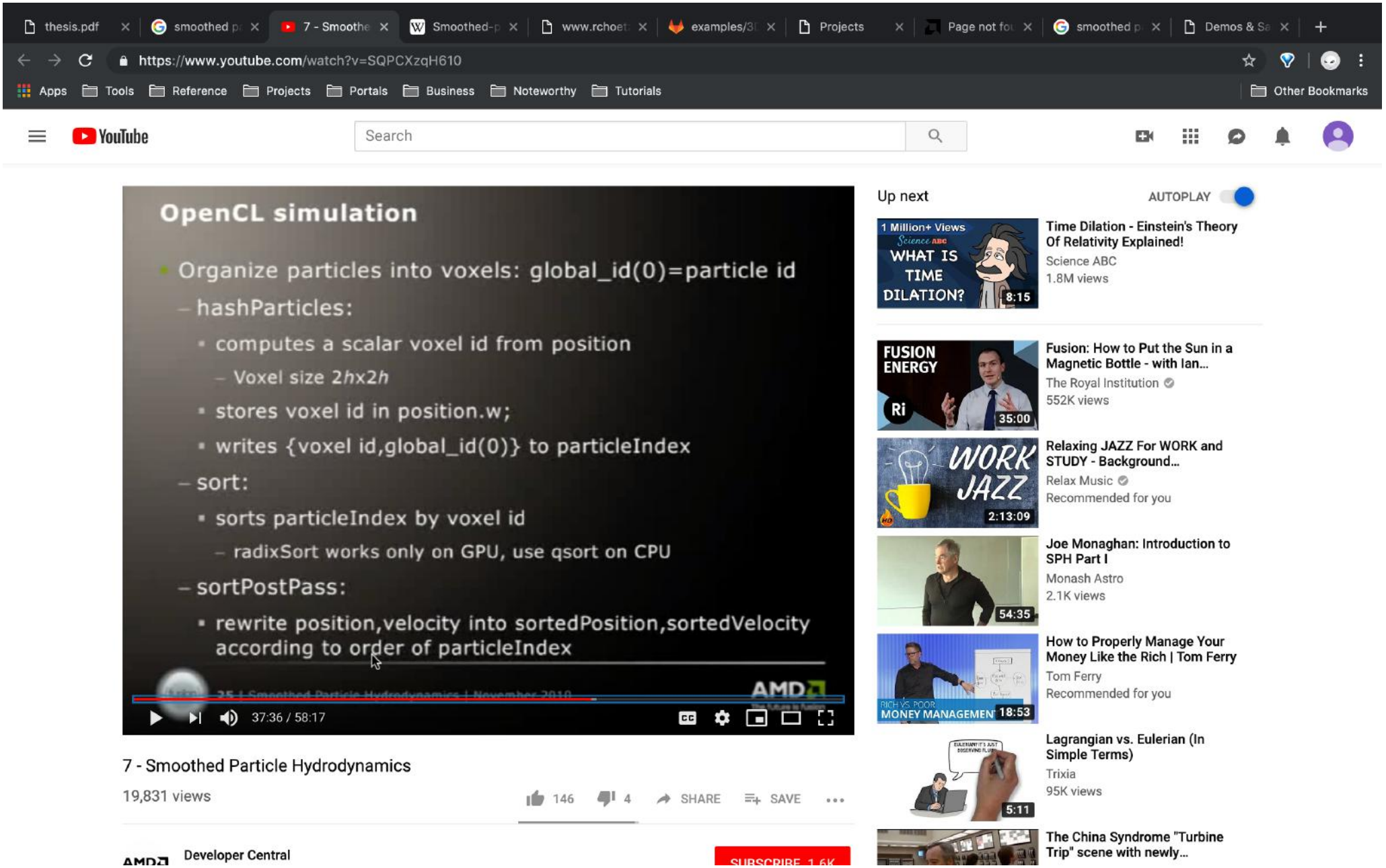
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Organize particles into voxels: global_id(0)=particle id
hashParticles:
computes a scalar voxel id from position
Voxel size 2hx2h
stores voxel id in position.w;
writes {voxel id,global_id(0)} to particleIndex
sort:
sorts particleIndex by voxel id
radixSort works only on GPU, use qsort on CPU
sortPostPass:
rewrite position,velocity into sortedPosition,sortedVelocity according to order of particleIndex
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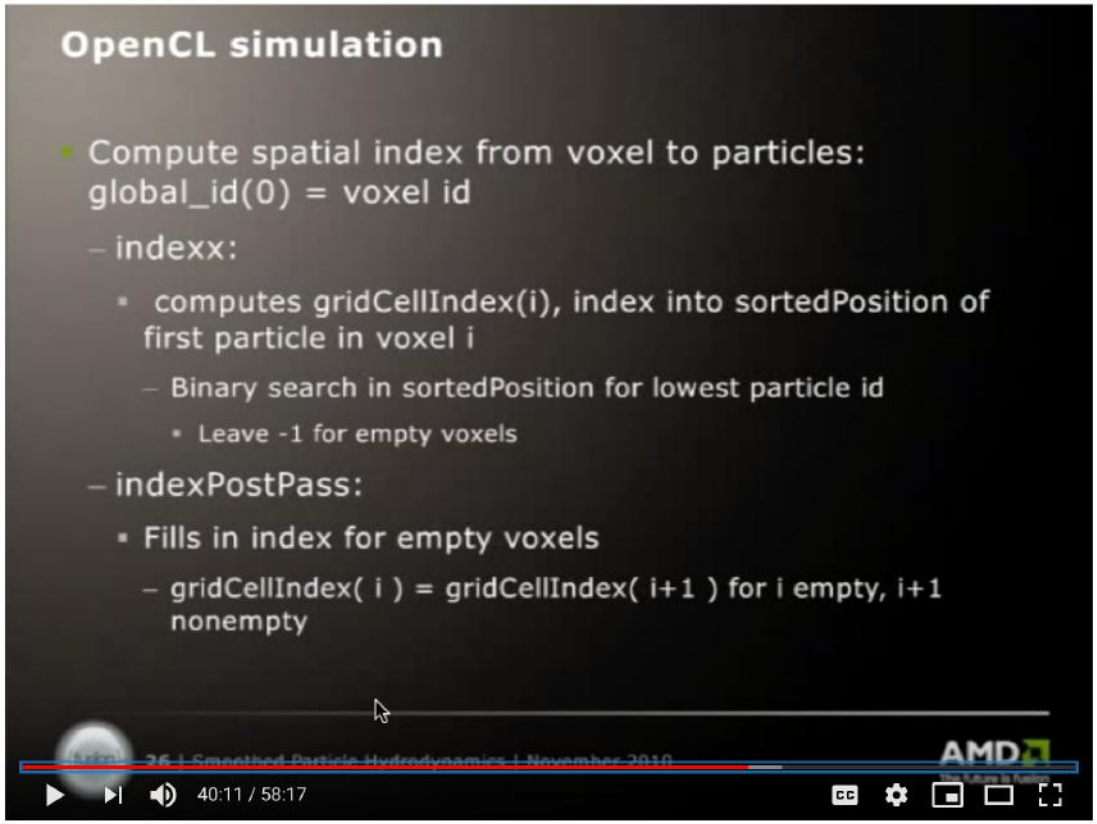


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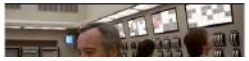

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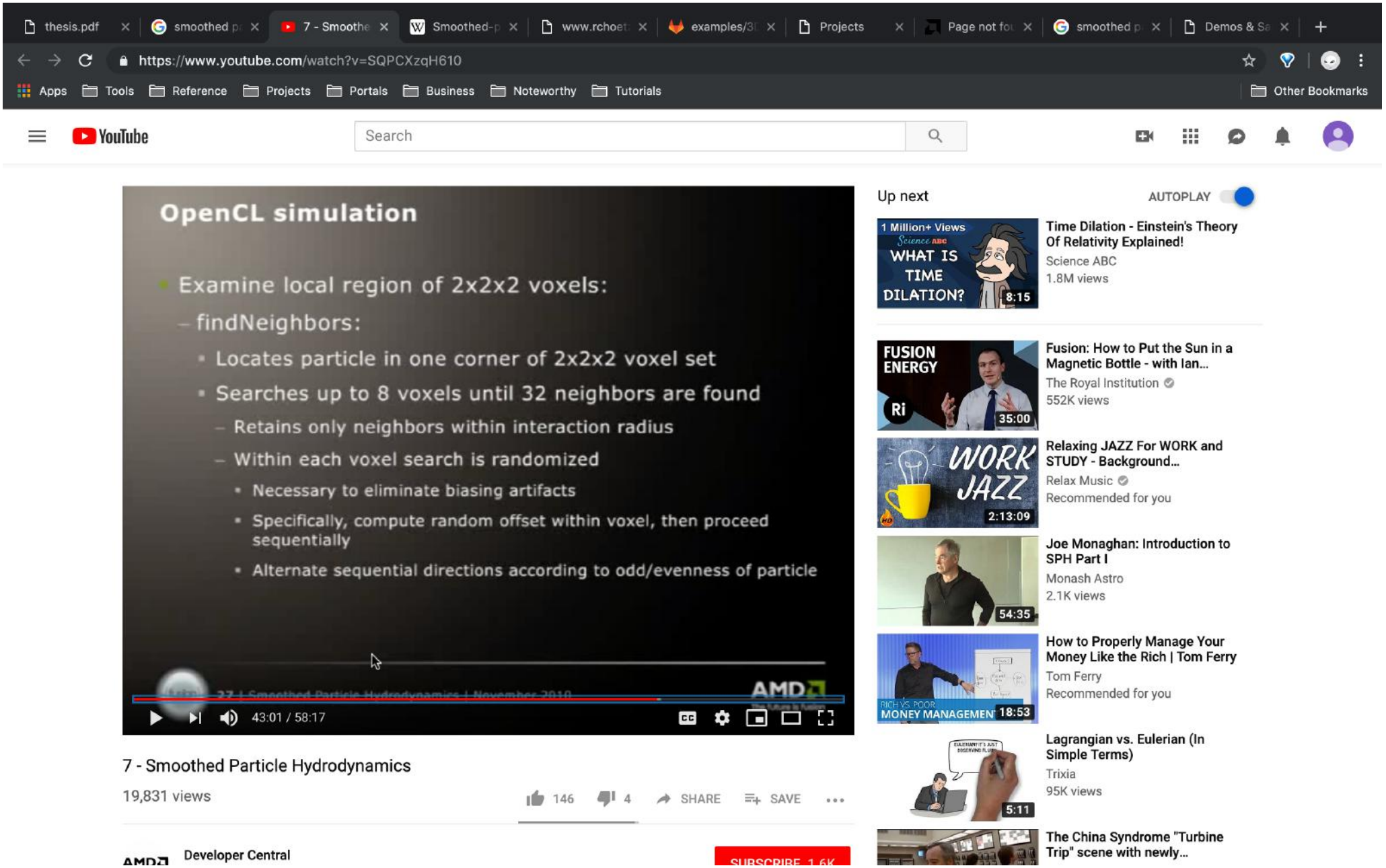
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Examine local region of 2x2x2 voxels:
findNeighbors:
Locates particle in one corner of 2x2x2 voxel set
Searches up to 8 voxels until 32 neighbors are found
Retains only neighbors within interaction radius
Within each voxel search is randomized
Necessary to eliminate biasing artifacts
Specifically, compute random offset within voxel, then proceed sequentially
Alternate sequential directions according to odd/evenness of particle
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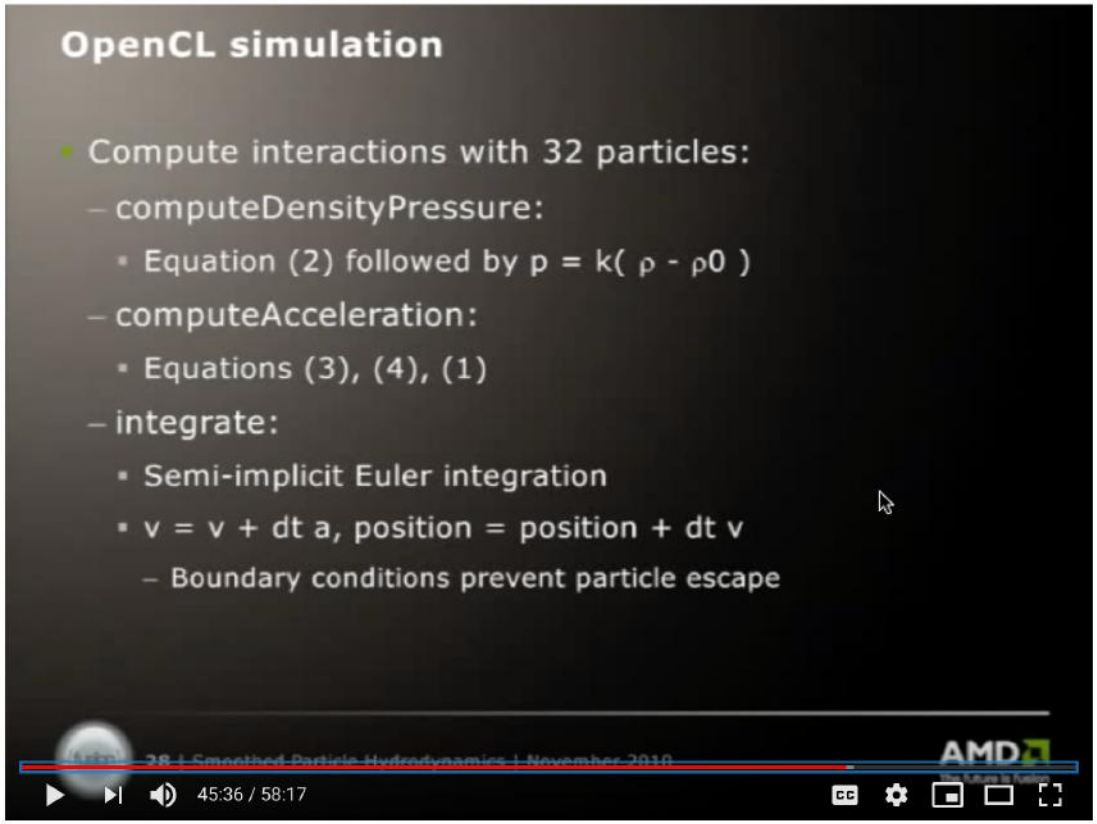


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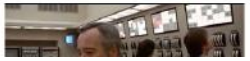

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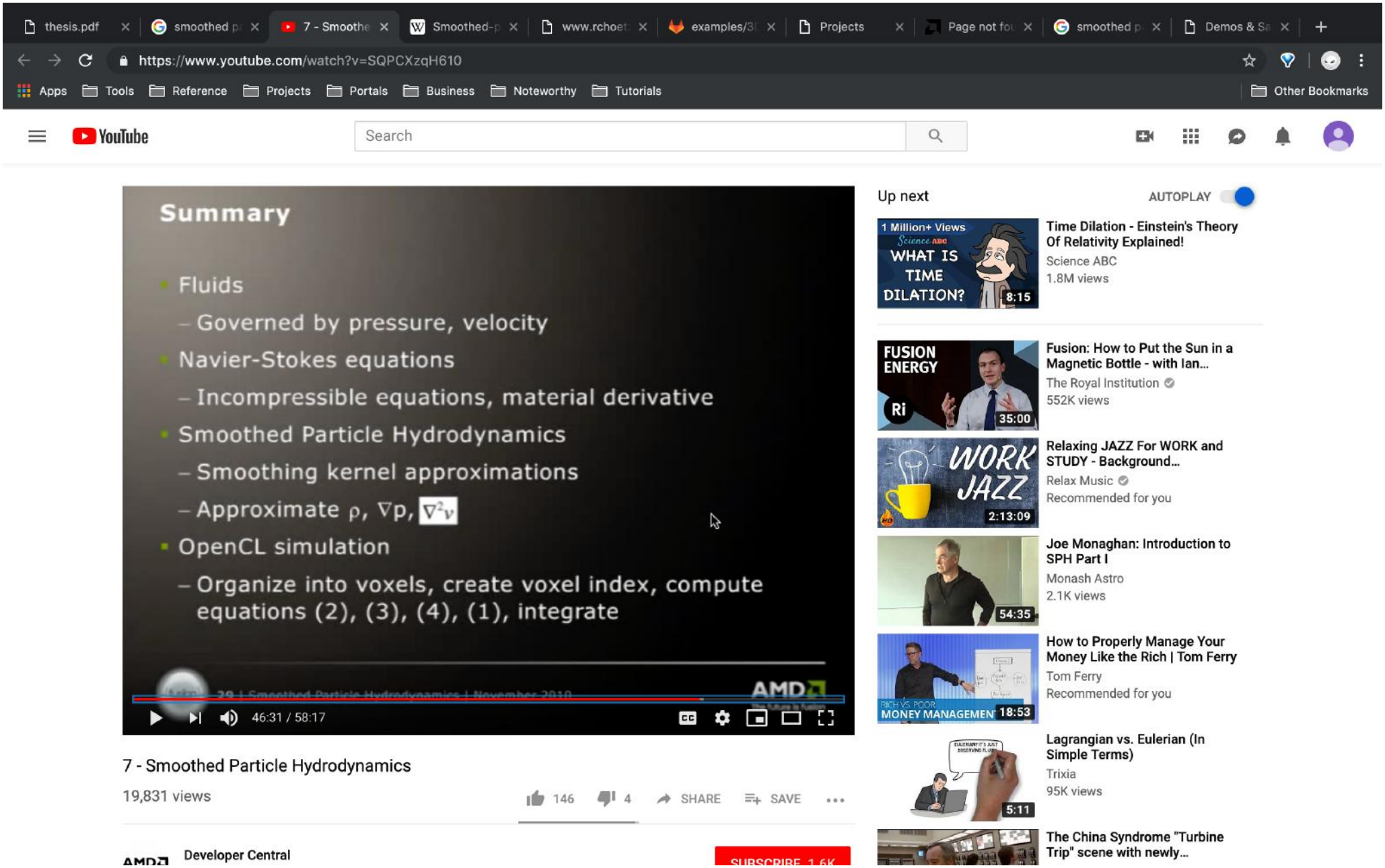
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