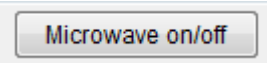


Tips for controls:

- To start the sim, students will need to turn on the microwave using the button in the right control panel. 
- Try all the different tabs at the top of the simulation. The tabs are designed to help teachers scaffold lessons or make lessons age appropriate by using only some tabs.
- You can **Pause** the sim and then use **Step** to incrementally analyze.

Important modeling notes / simplifications:

- This sim is specifically design to introduce how waves can initiate and change molecular motion in a real-world situation. In addition, to show multiple representations for microwaves. However, it doesn't show vibrational motion of the atoms within the molecule.
- Information about the different tabs:
 - The water molecules are unlikely to be stationary; the first three tabs start with the molecules fixed to help students focus on changes.
 - The decision to make the sim start on the second tab was intentional. The tabs are in order of increasing complexity, but starting the user in the more complex system appears to be more effective for initiating engagement.
 - The **One Molecule** tab, demonstrates only the rotational motion effects of microwaves in a very over simplified setting; no translational motion is shown.
 - The **Single Line of Molecules** tab starts with the molecules in a straight line (also over simplified setting) to help students focus on the motion changes, but the molecules do translate.
 - The **Many Molecules** tab is meant to show a more realistic view of liquid water, but the molecules are “stationary” before the waves start as if the sim were paused.
 - The **Coffee** tab, is the most realistic (with the exception that vibration within the molecule is not shown)
- Known issues: This is an older sim and has some reported bugs in **Views**. The view labeled as **Curve** is actually a curve with vectors. (In [Radio Waves](#), this is labeled "Curve with vectors"). The view **Single line** is actually a line of vectors. If the microwave is off, the option called **Curve** shows a single line, but **Single line** doesn't.

Insights into student use / thinking:

- Students are likely to be surprised that microwaves have a variety of frequencies and amplitudes. The sim shows that variations effect changes in water differently.
- Staring on the second tab doesn't fit the current design principals but it was effective and not confusing during interviews.

Suggestions for sim use:

- For tips on using PhET sims with your students see: [Guidelines for Inquiry Contributions](#) and [Using PhET Sims](#)
- The simulations have been used successfully with homework, lectures, in-class activities, or lab activities. Use them for introduction to concepts, learning new concepts, reinforcement of concepts, as visual aids for interactive demonstrations, or with in-class clicker questions. To read more, see [Teaching Physics using PhET Simulations](#)
- For activities and lesson plans written by the PhET team and other teachers, see: [Teacher Ideas & Activities](#)
- **Related sims:** [States of Matter](#) introduces molecular motion as it relates to temperature and pressure. [Gas Properties](#) provides many measurement and comparison opportunities for ideal gases.