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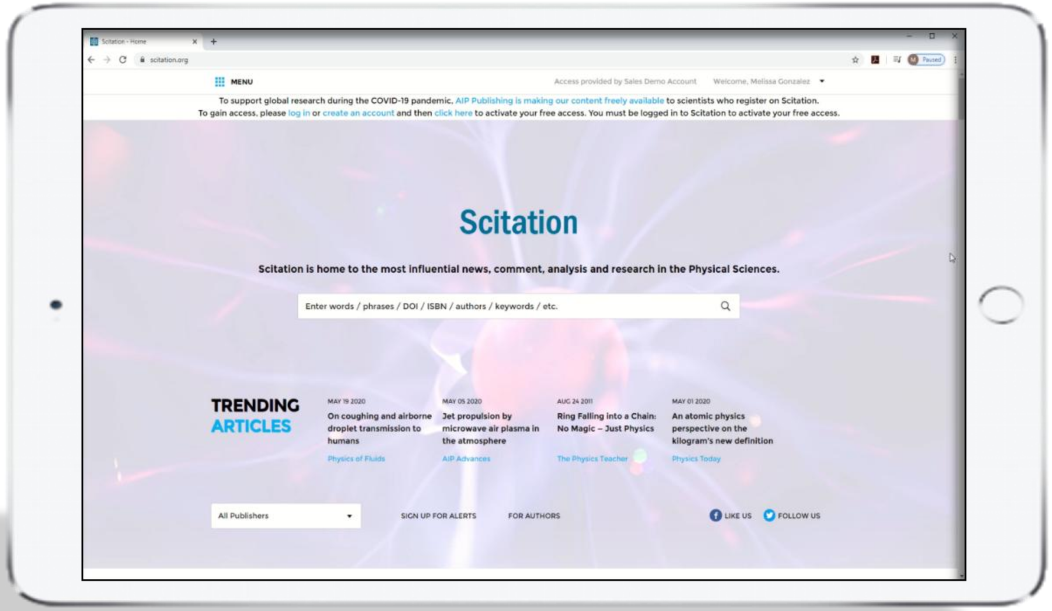

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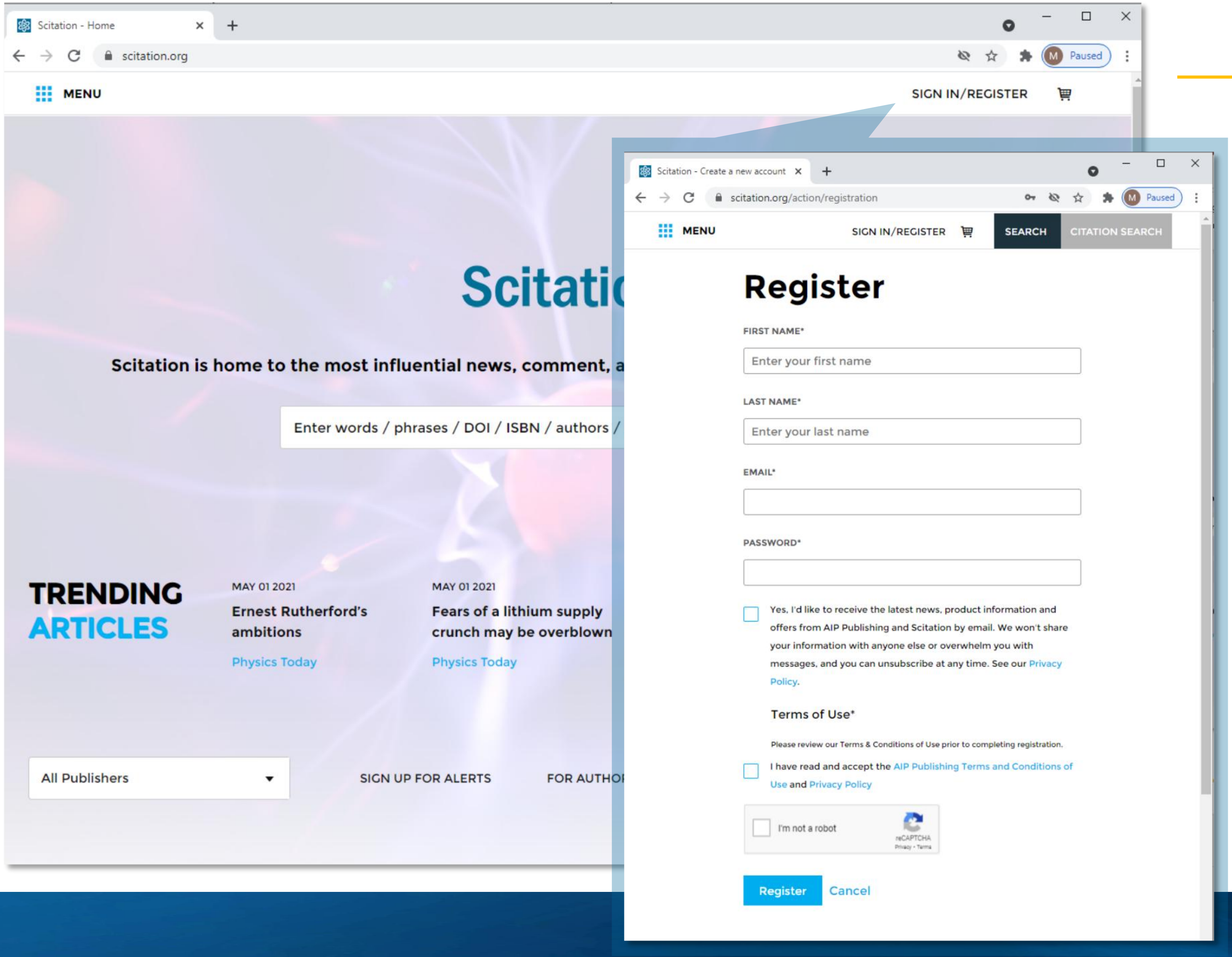

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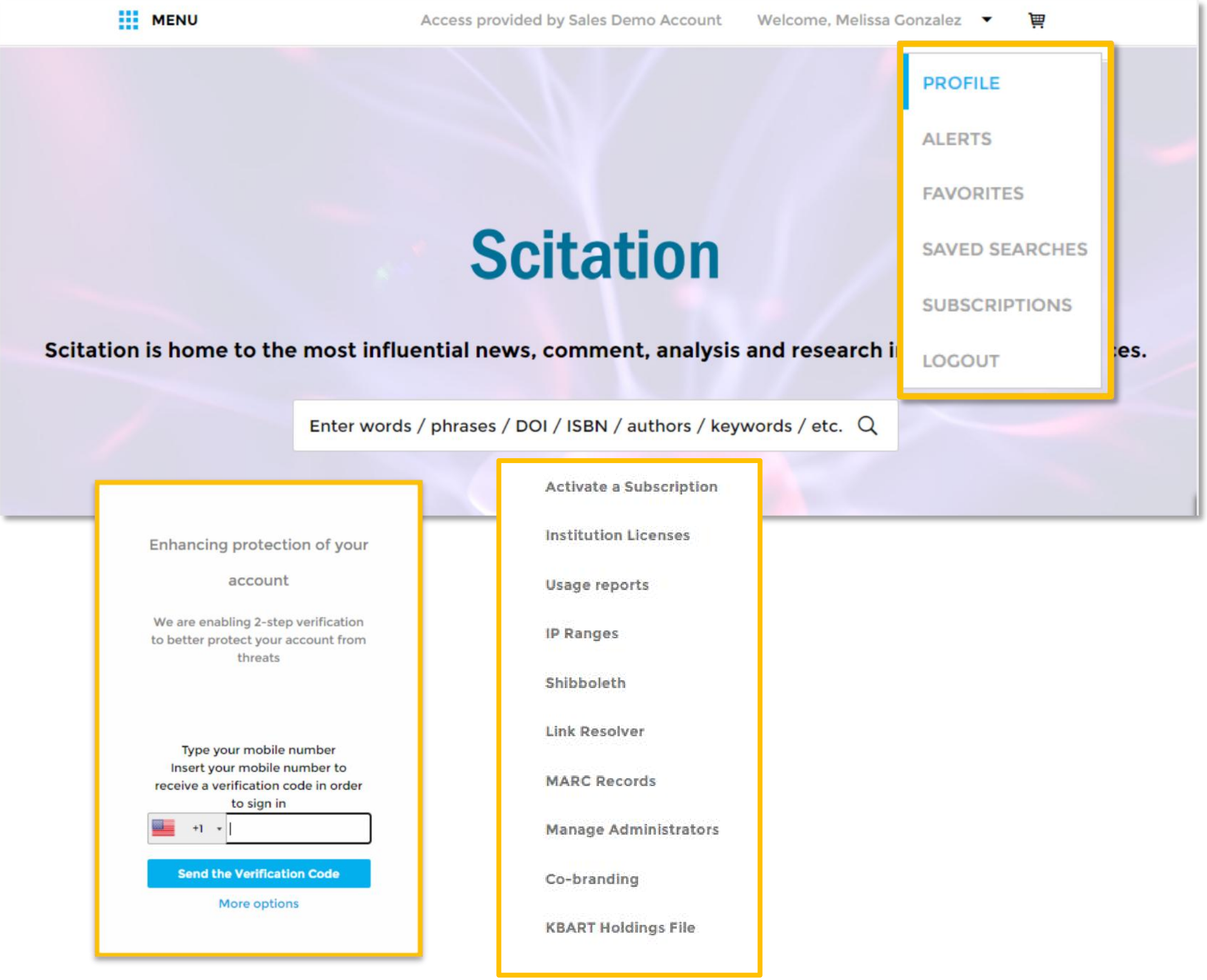

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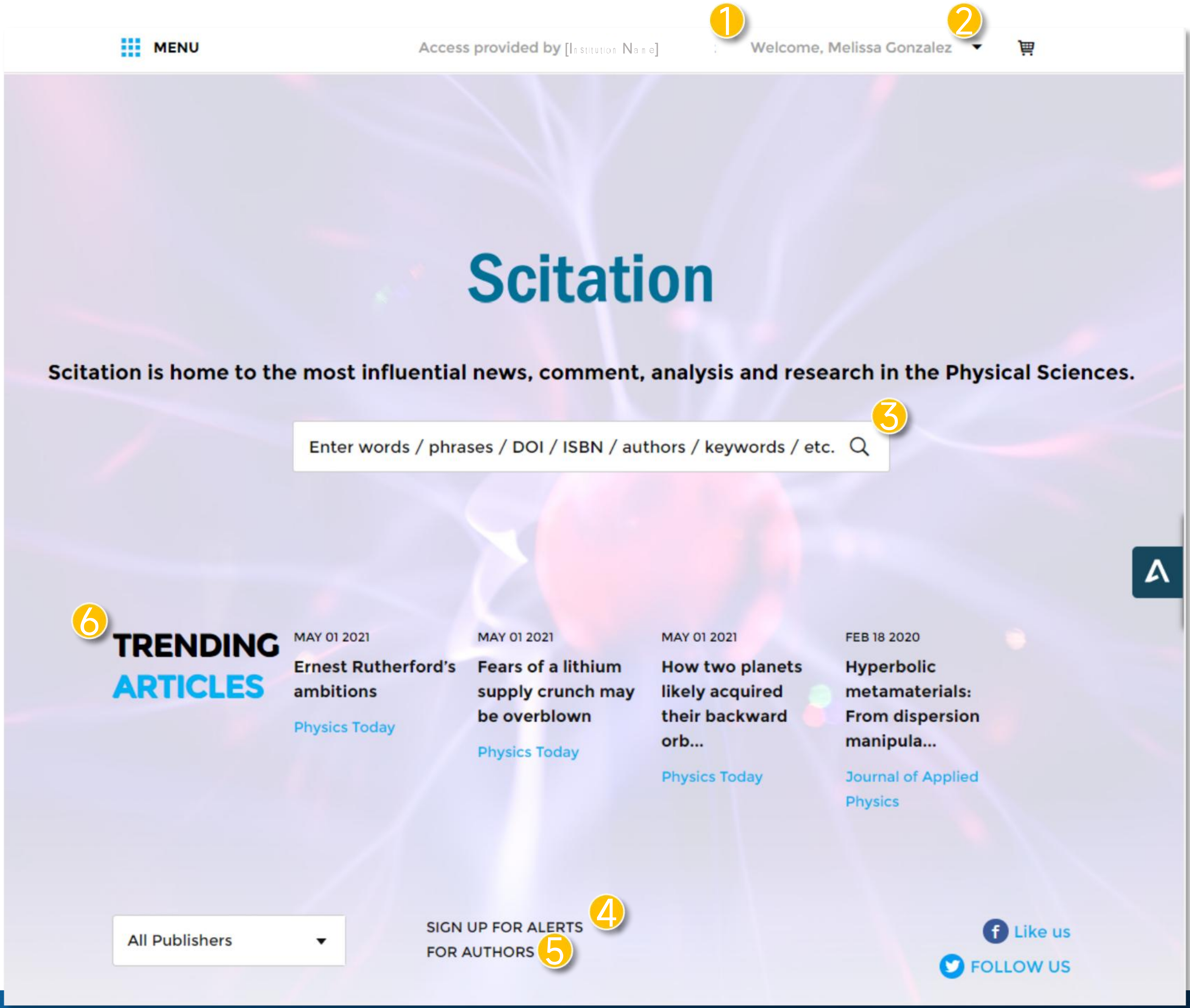

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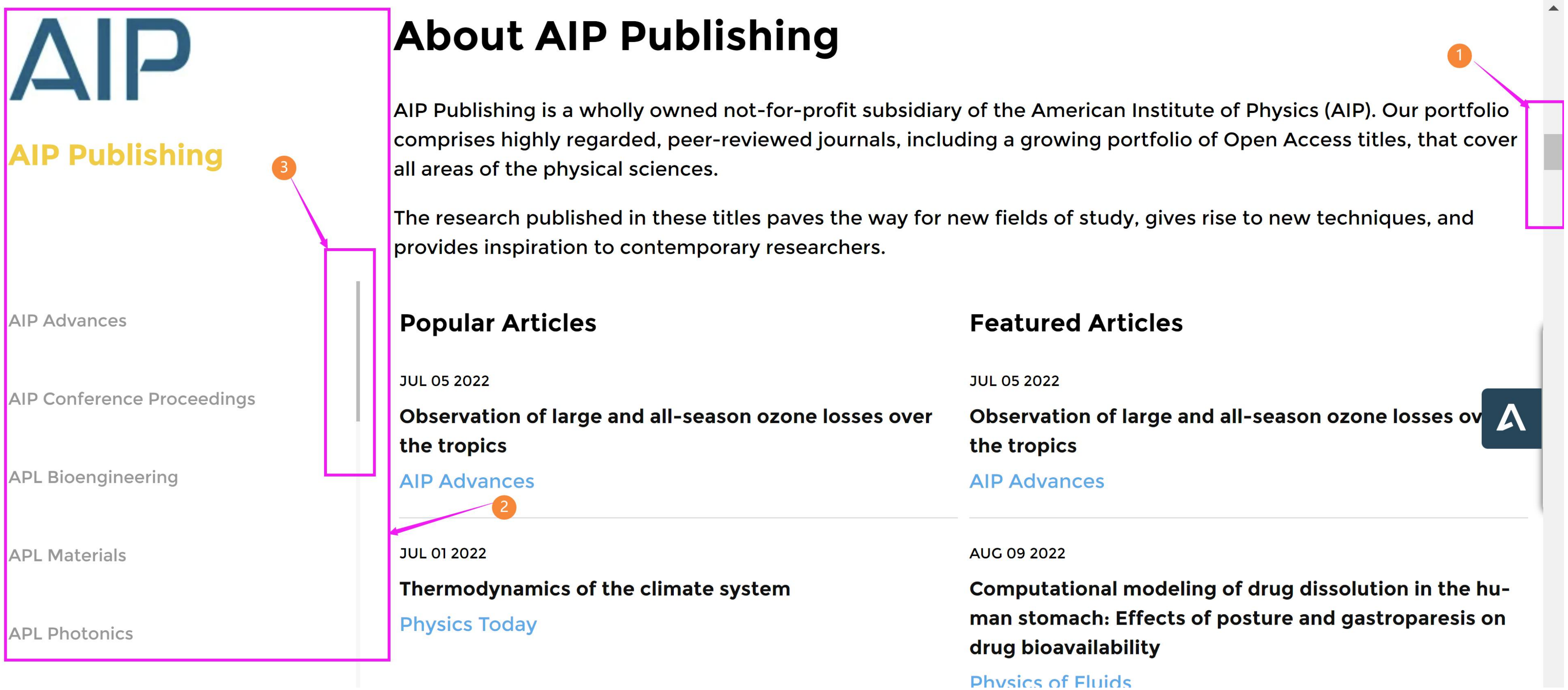

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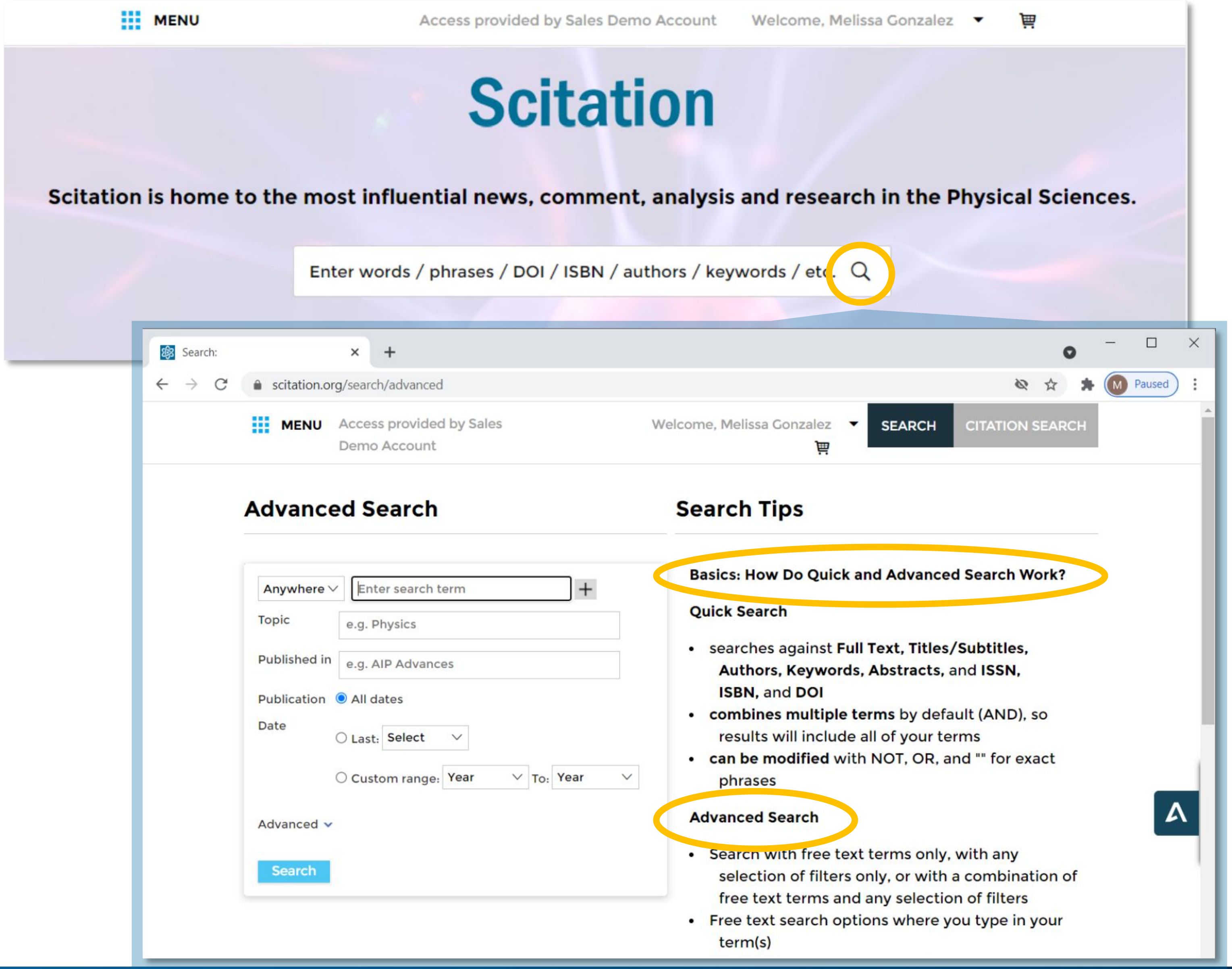

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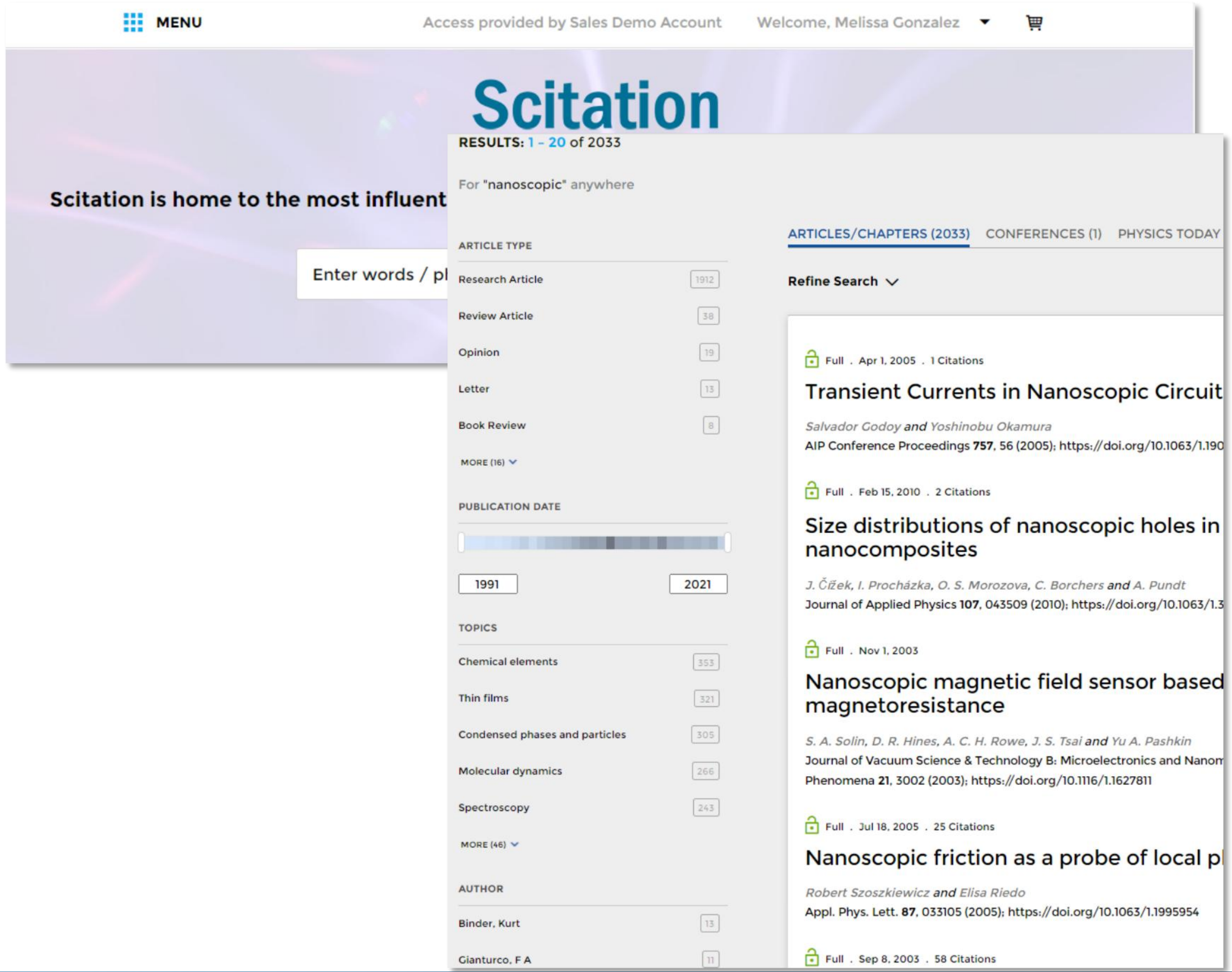

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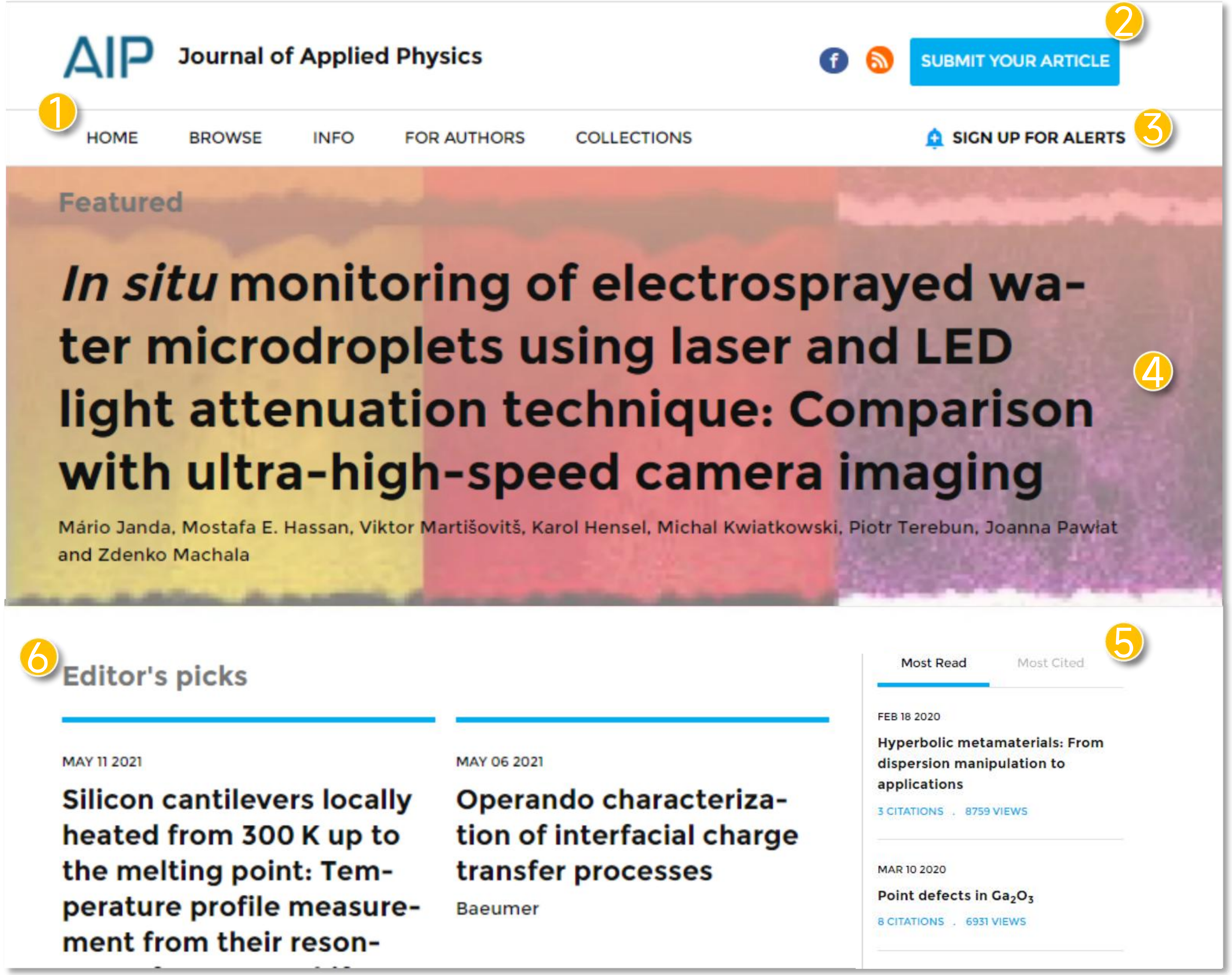

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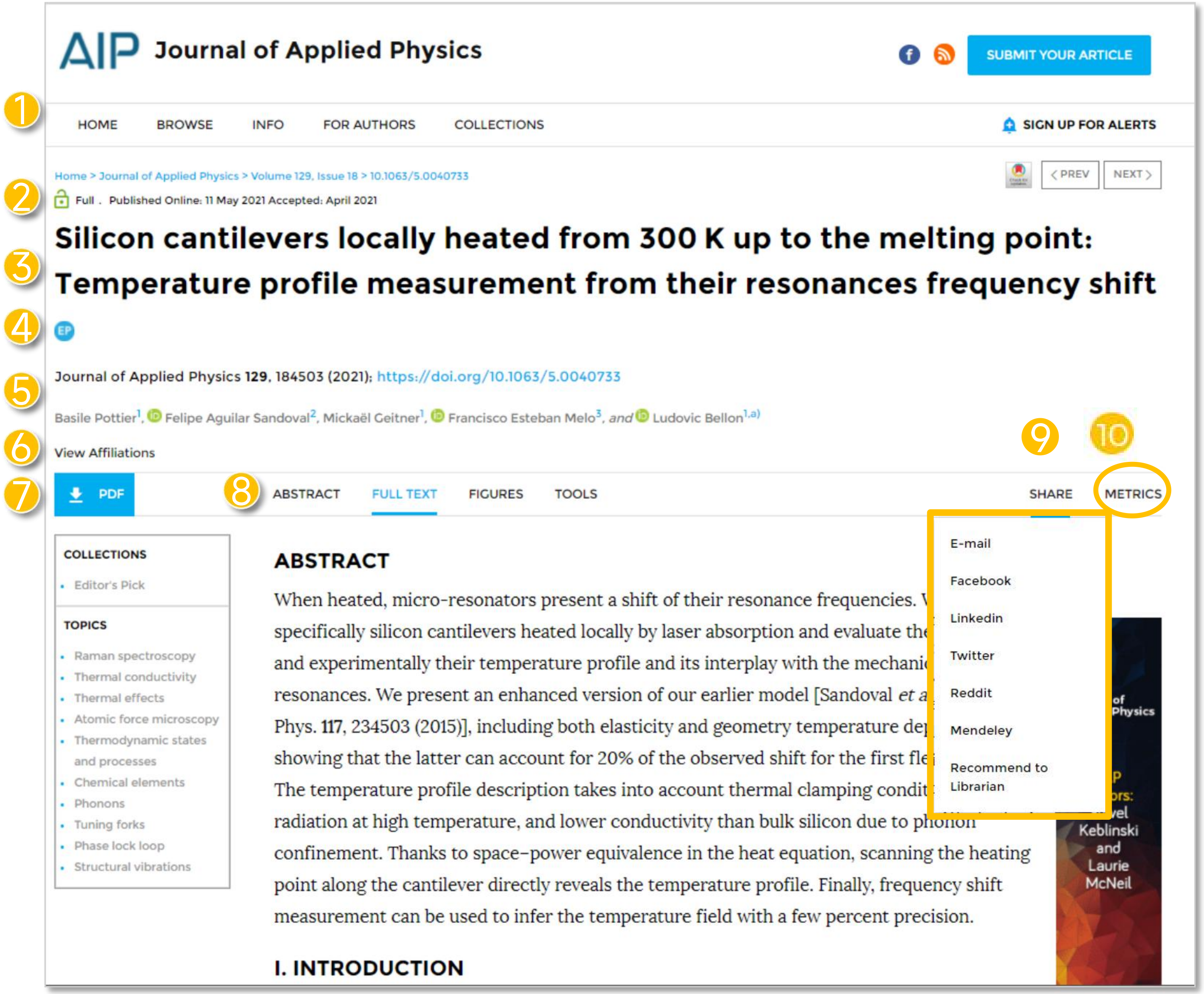

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Silicon cantilevers locally heated from 300 K up to the melting point: Temperature profile measurement from their resonances frequency shift

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Journal of Applied Physics **129**, 184503 (2021); https://doi.org/10.1063/5.0040733

Basile Pottier[1], Felipe Aguilar Sandoval[2], Mickaël Geitner[1], Francisco Esteban Melo[3], *and* Ludovic Bellon[1,a)]

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ABSTRACT

When heated, micro-resonators present a shift of their resonance frequencies. V
specifically silicon cantilevers heated locally by laser absorption and evaluate the
and experimentally their temperature profile and its interplay with the mechani
resonances. We present an enhanced version of our earlier model [Sandoval *et a*
Phys. 117, 234503 (2015)], including both elasticity and geometry temperature dep
showing that the latter can account for 20% of the observed shift for the first fle
The temperature profile description takes into account thermal clamping condit
radiation at high temperature, and lower conductivity than bulk silicon due to phonon
confinement. Thanks to space–power equivalence in the heat equation, scanning the heating
point along the cantilever directly reveals the temperature profile. Finally, frequency shift
measurement can be used to infer the temperature field with a few percent precision.

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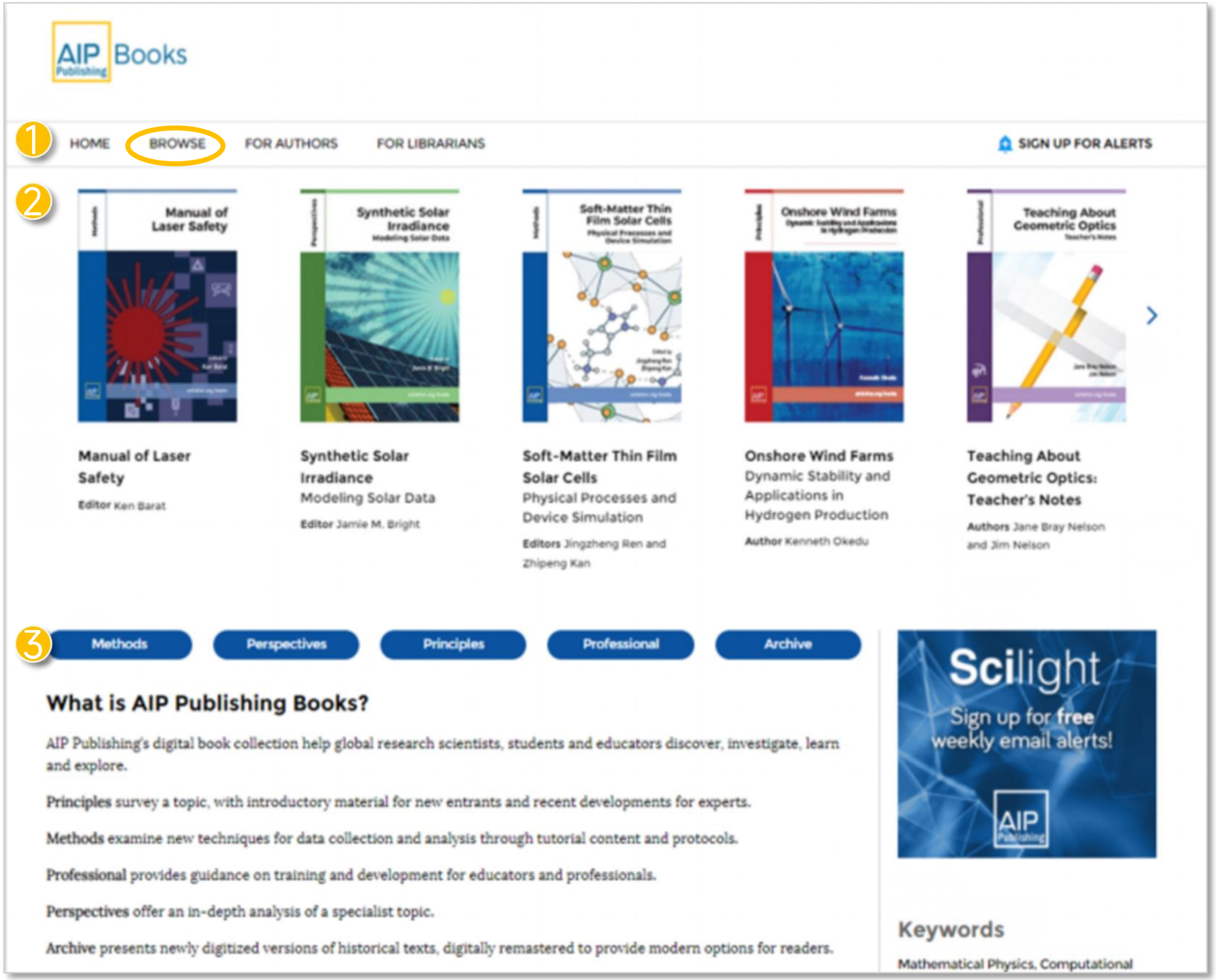

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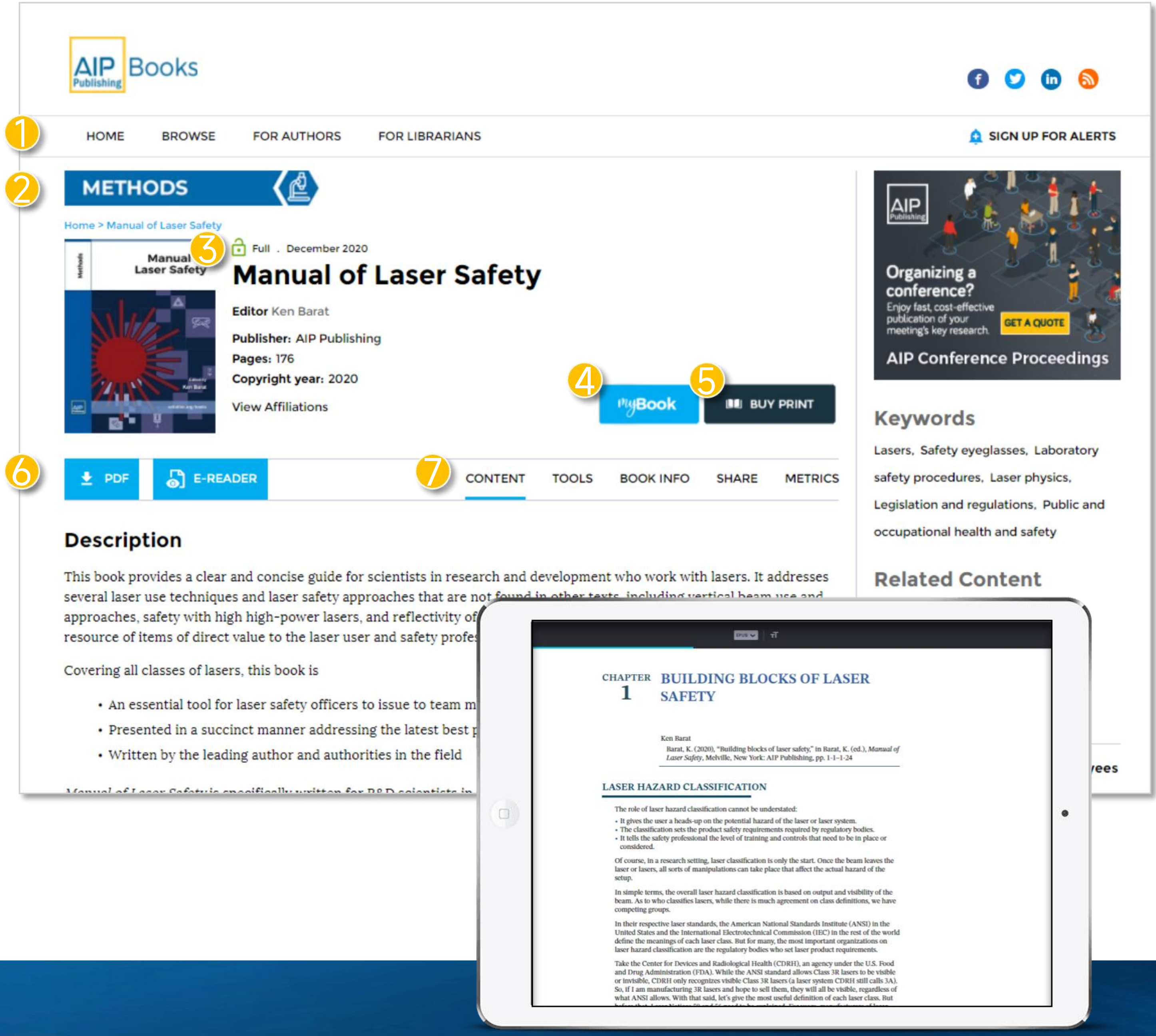

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Editor Ken Barat

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Ken Barat

Barat, K. (2020), "Building blocks of laser safety," in Barat, K. (ed.), *Manual of Laser Safety*, Melville, New York: AIP Publishing, pp. 1-1–1-24

LASER HAZARD CLASSIFICATION

The role of laser hazard classification cannot be understated:

- It gives the user a heads-up on the potential hazard of the laser or laser system.
- The classification sets the product safety requirements required by regulatory bodies.
- It tells the safety professional the level of training and controls that need to be in place or considered.

Of course, in a research setting, laser classification is only the start. Once the beam leaves the laser or lasers, all sorts of manipulations can take place that affect the actual hazard of the setup.

In simple terms, the overall laser hazard classification is based on output and visibility of the beam. As to who classifies lasers, while there is much agreement on class definitions, we have competing groups.

In their respective laser standards, the American National Standards Institute (ANSI) in the United States and the International Electrotechnical Commission (IEC) in the rest of the world define the meanings of each laser class. But for many, the most important organizations on laser hazard classification are the regulatory bodies who set laser product requirements.

Take the Center for Devices and Radiological Health (CDRH), an agency under the U.S. Food and Drug Administration (FDA). While the ANSI standard allows Class 3R lasers to be visible or invisible, CDRH only recognizes visible Class 3R lasers (a laser system CDRH still calls 3A). So, if I am manufacturing 3R lasers and hope to sell them, they will all be visible, regardless of what ANSI allows. With that said, let's give the most useful definition of each laser class. But

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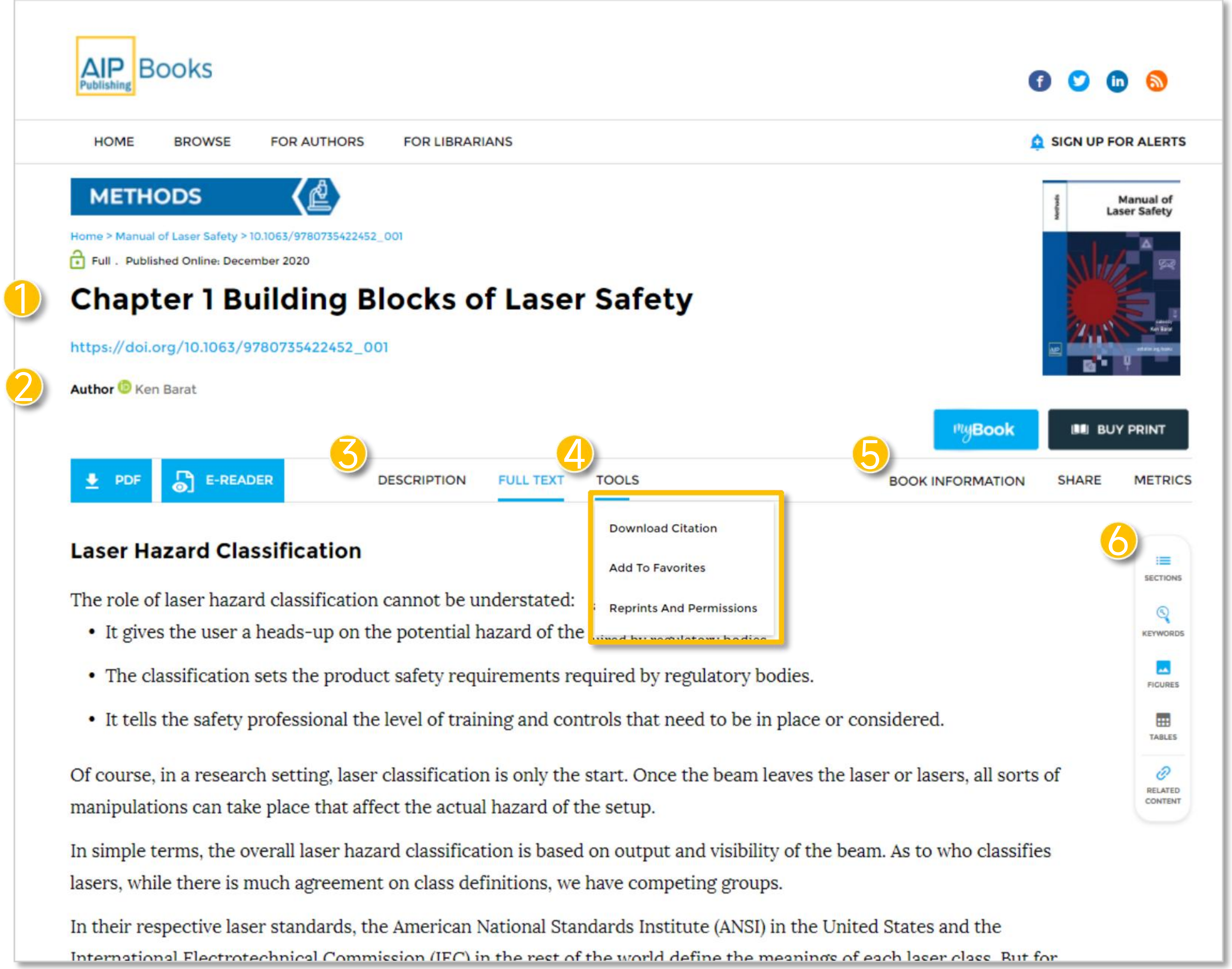
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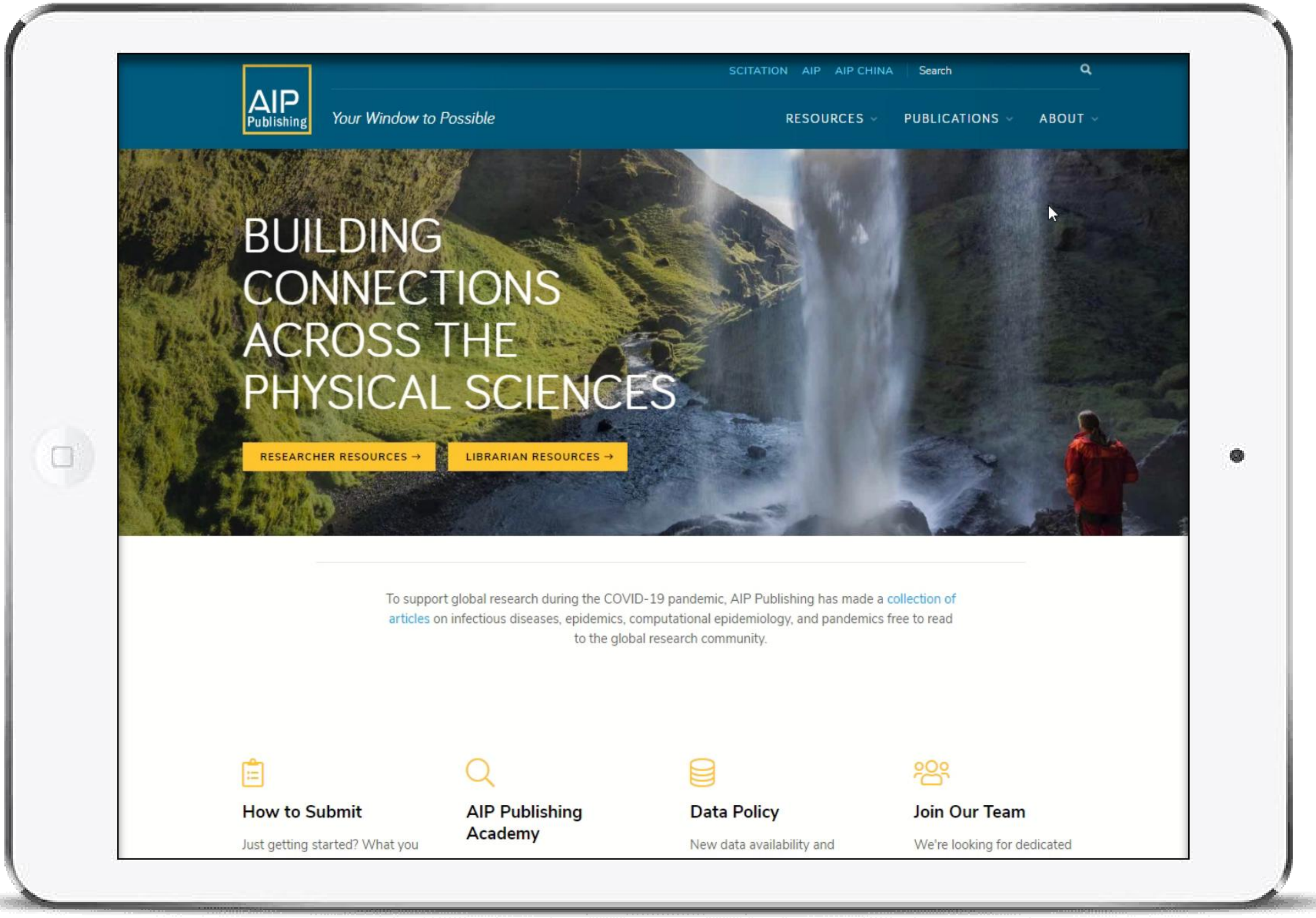

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