



Katherine Johnson, 1918-2019

Why the caged bird sings

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# Free waves

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- Can have any primary wavelength (color, pitch)
- Move (always)
- Have a ripple length, and thus range of color
- Have a ripple width (very wide)

# Trapped guitar strings

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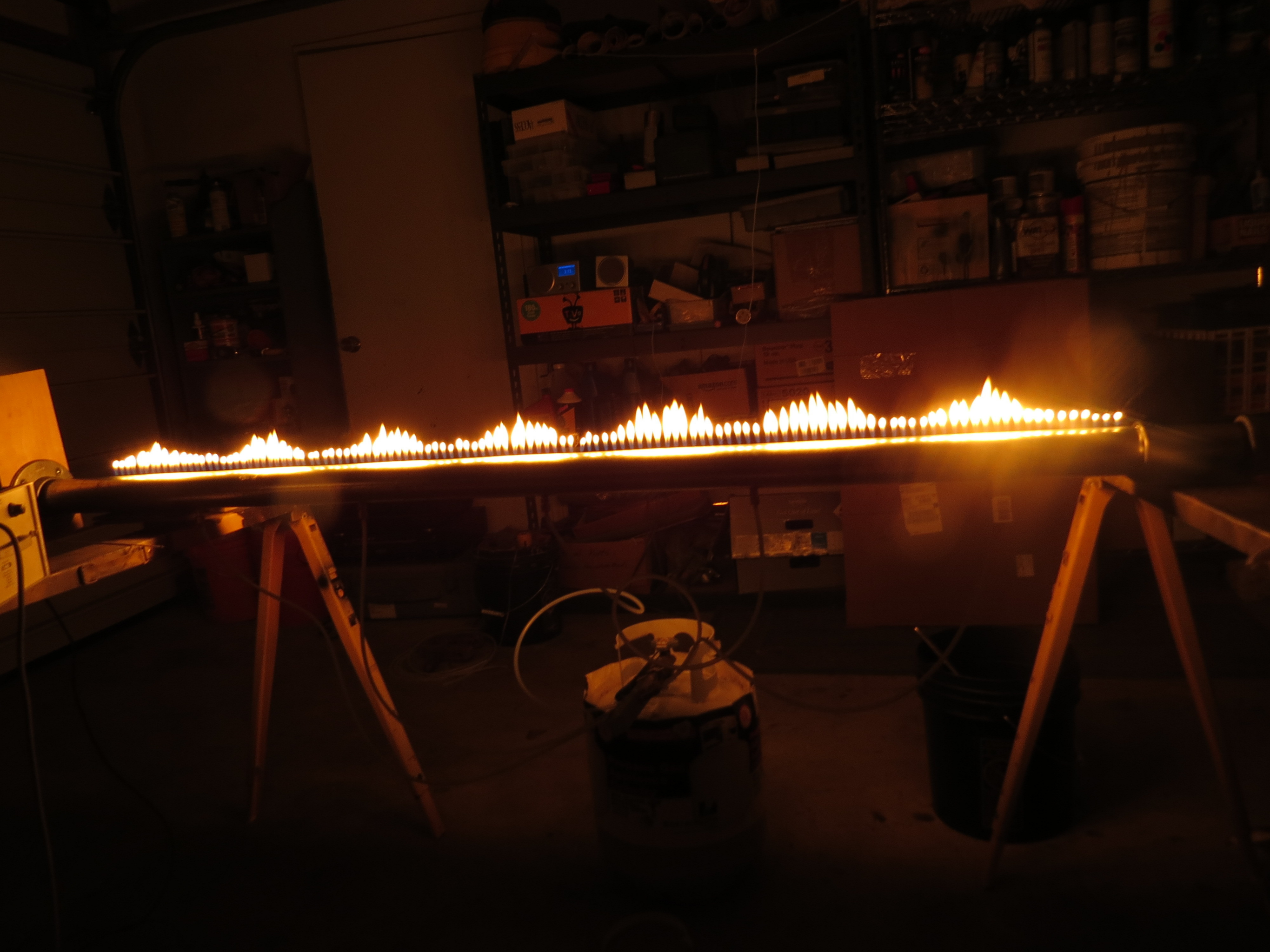
Result of color coating



# String demo

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# Sound in a pipe

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# Demo

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- Change length
- Nodes & anti-nodes

# Trapped waves

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- Can only have wavelengths (colors, pitches) that fit in the trap. Colors are ***discrete***.
- Stay within the strap (~stationary)
- Have very narrow color ranges

# Drums

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# Demo

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# Quantum corral

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