Supplementary information:

Optomechanical metamaterial nanobolometer

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Table S1: Mechanical and thermal properties of silicon nitride and gold.

	Silicon nitride (SiN)	**Gold (Au)**
Young's modulus, E (GPa)	260	77
Density, ρ (kg m^{-3})	3 100	19 300
Thermal expansion coeff. α (K^{-1})	2.8×10^{-6}	14.2×10^{-6}
Volumetric heat capacity, c (J cm^{-3} K^{-1})	2.1	2.5

Note S1: Effective thermal expansion coefficient of nanowires

The effective thermal expansion coefficients of the nanowires are given by the weighted average of those for silicon nitride and bilayer sections of the nanowires, see Table 1. The effective thermal expansion coefficient of a bilayer of two materials is given by the equilibrium thermal expansion and layer strain. For gold and silicon nitride layers of equal thickness, $\alpha_{\text{bilayer}} = (\alpha_{\text{SiN}}E_{\text{SiN}} + \alpha_{\text{Au}}E_{\text{Au}})/(E_{\text{SiN}} + E_{\text{Au}}) = 5.4 \times 10^{-6}\ \text{K}^{-1}$.

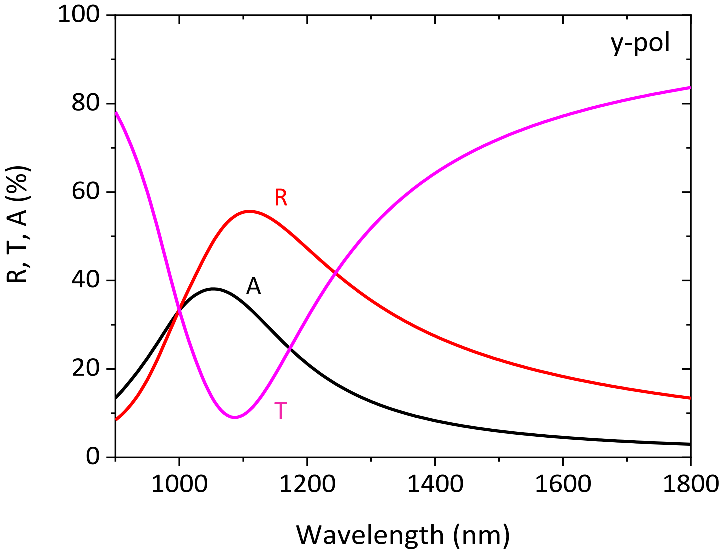

Fig. S1. Optical properties of the nanomechanical metamaterial bolometer array for normally incident light polarized perpendicular to the silicon nitride nanowires. Simulated transmission (T), reflection (R) and absorption (A) spectra without nanowire displacement.

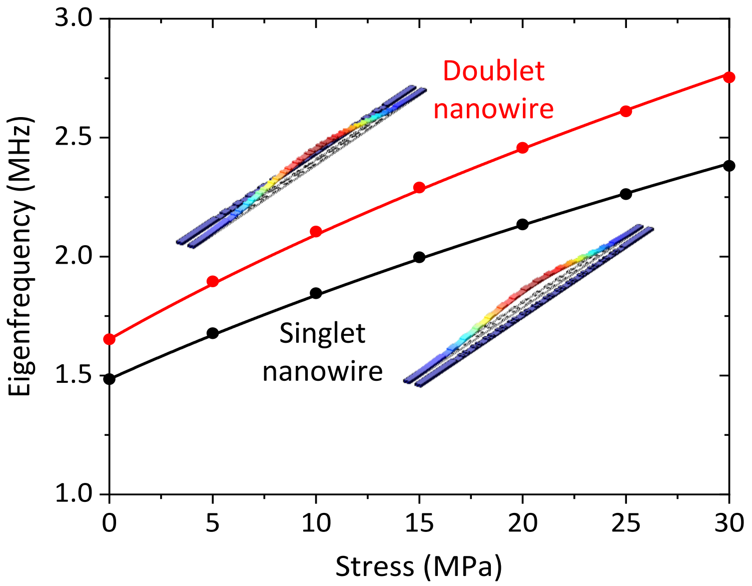

Fig. S2. Simulated mechanical eigenfrequencies of the two metamaterial nanowires for different values of tensile stress (dots) with fits according to Eq. (1) (lines) and finite element method simulations of the respective mechanical modes (insets). The simulations were performed with COMSOL 5.3a.

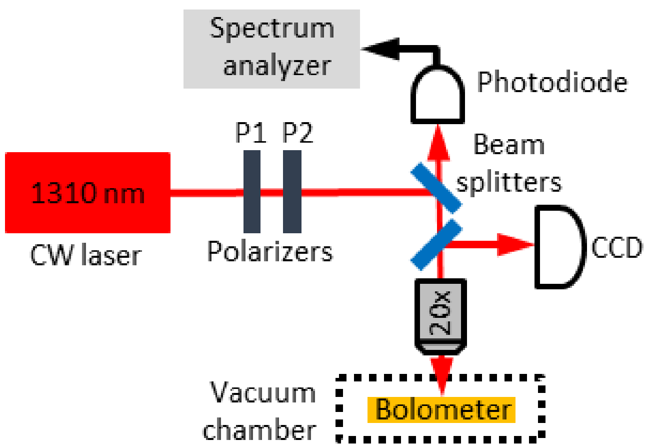

Fig. S3. Experimental setup for nanobolometer readout and characterization. Polarizer P1 controls the incident laser power while polarizer P2 is set to polarize the electric field parallel to the nanowires.

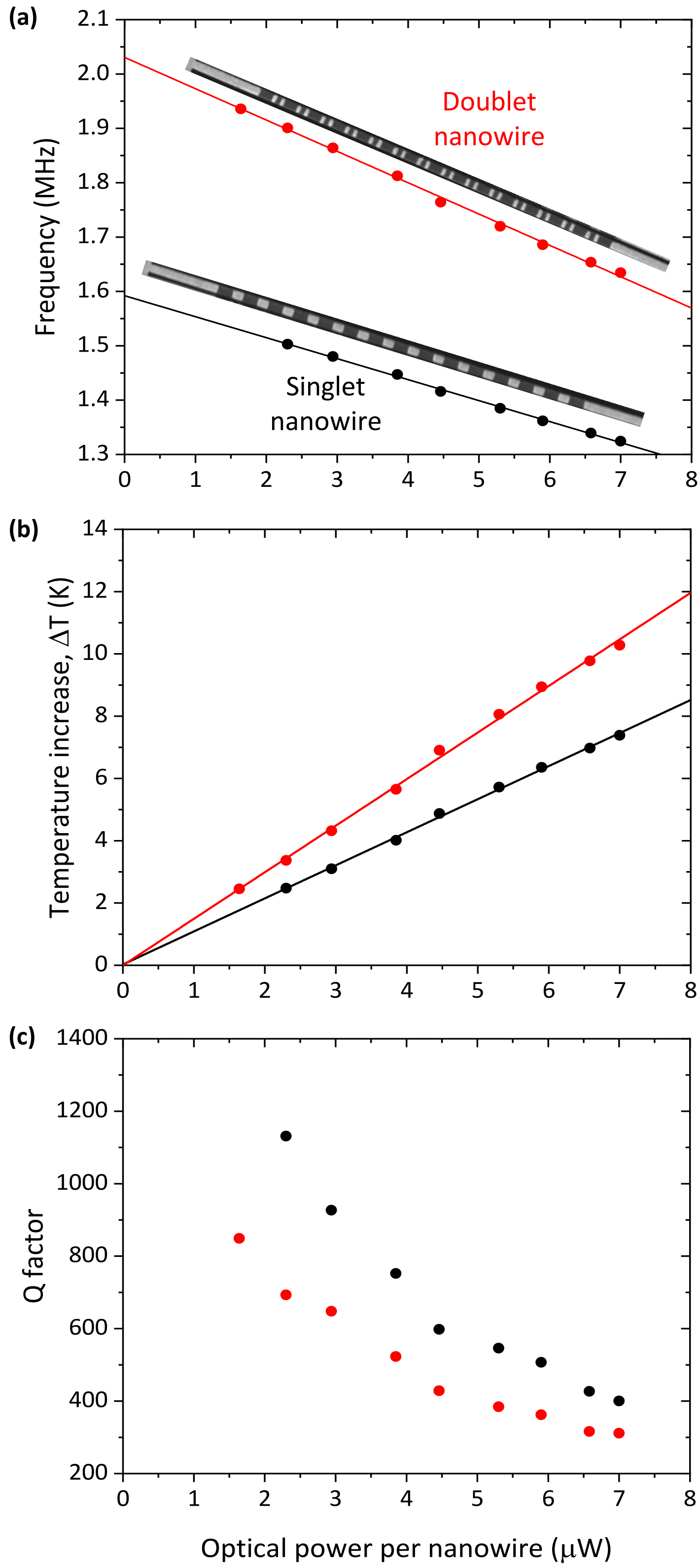

Fig. S4. Optical power dependence of metamaterial nanowire properties. (a) Measured fundamental mechanical resonance frequencies, (b) the corresponding temperature increase according to Eq. (3) and (c) measured mechanical resonance Q factors of the singlet (black) and doublet (red) nanowires as a function of laser power incident on a nanowire. Lines are linear fits.

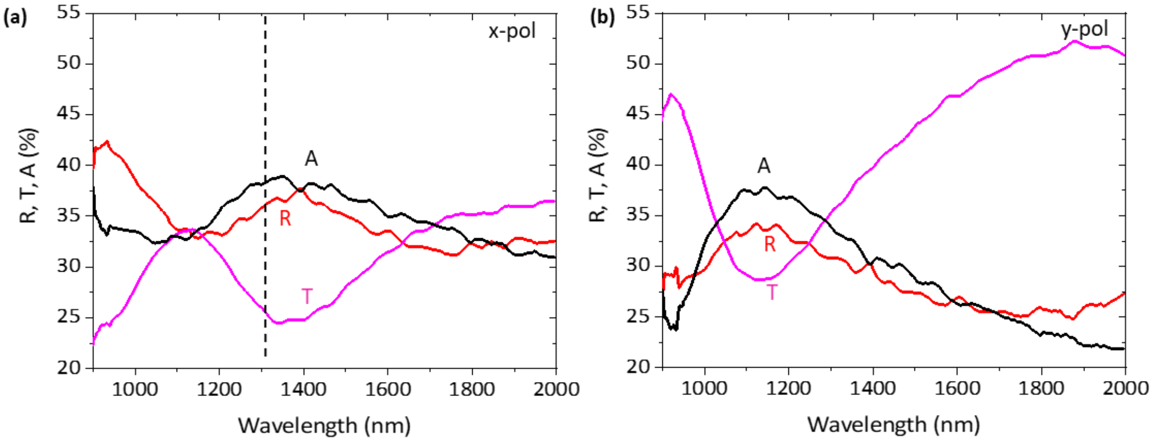

Fig. S5. Measured reflection (R), transmission (T) and absorption (A) of the nanomechanical metamaterial bolometer array for light polarized (a) parallel and (b) perpendicular to the nanowires. The spectra were recorded with a CRAIC microspectrophotometer (numerical aperture 0.28) at normal incidence on the central 10 x 10 μm^2 of the metamaterial.