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**nonlinear propagation in microbubble cloud, does it make the**  
**distal myocardium appear brighter or darker?**

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A number of questions remain in contrast ultrasound imaging regarding the complex interaction between bubbles, US and tissue. E.g. in contrast echocardiography for perfusion imaging, it is sometimes difficult to interpret the images for the myocardium distal to the probe. Due to US nonlinear propagation through the bubble-filled chamber, the distal part can appear artefactually brighter or darker in e.g. Pulse Inversion images. Although tissue at target is likely to increase in brightness in contrast specific images when nonlinear propagation happens, it is less clear for microbubbles.

This work tries to gain better understanding on this by investigating how nonlinear propagation of ultrasound pulses can change the appearance of microbubbles and tissues in Pulse Inversion images by altering their acoustic response. A series of specifically designed simulations and experiments were performed. The results show that nonlinear propagation can have a significant impact on the appearance of tissue containing bubbles, and this varies with insonating frequency and pressure. These results suggest mechanism involves a balance between a reduction in nonlinear bubble scattering after propagation against an increase in the nonlinear tissue scattering. Consequently the deeper tissues containing bubbles may appear brighter or darker depending on the relative contribution of these two effects.