INSTRUCTIONS FOR AUTHORS

General Information

- **Paper must be written in English.** Authors whose native language is not English are recommended to seek the advice of a native English speaker, if possible, before submitting their papers.

- No more than one paper per registration fee will be included in the Proceedings for those participants who have paid reduced registration fee (students and participants supported by stipends from the Organizing Committee). Full participants ($250-300) do not have such a restriction.

- Length of paper in final layout:
    Regular paper -- **four** pages;
    Invited paper -- up to **eight** pages

- The paper should be submitted electronically as a **pdf document**.

- The deadline for the electronic submission is **10 August, 2002**. Please send an e-mail message with attached pdf file to isna16@acs366b.phys.msu.su
Use subject "**Paper for the ISNA-16 Proceedings**" for this e-mail message.

- In addition to the electronic submission, an envelope containing printed hardcopy of the paper and a diskette or CD with the original electronic document should be given to the Organizing Committee during the on-site registration 18-19 August, 2002.

- Tentative publication date is March 2003.

- If you have any questions on the paper preparation, please see the section *Proceedings* at the ISNA-16 website http://acs366.phys.msu.su/isna16 or contact the Organizing Committee by email isna16@acs366b.phys.msu.su

Format
(see 4-page example at the end of this document)

- Page orientation – portrait
- **Page size: A4 (210 x 297 mm)**
- **Size of text area: 148 x 219 mm**
- Margins:

  top – 39 mm, bottom – 39 mm, left – 31 mm, right – 31 mm.

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(see 4-page example at the end of this document)

Spacing: Use **single spacing throughout**.

First page:

Drop 36 pt (i.e. 1/2 inch) from the top margin.

Include the full title of the paper: 20 pt Times New Roman, **Bold**, **Cap/lowercase**, centered

Drop 24pt

Include authors' initials followed by last name: 14 pt Times New Roman, Cap/lowercase, centered. Separate authors' names by commas, put superscript symbols *, †, ‡, §, or # at the end of the names to mark authors with different affiliations.

Drop 24pt

Include each author's affiliation and complete addresses (including zip and postal codes and country), put semicolon and then the word "*E-mail:*" followed by e-mail address of the corresponding coauthor(s). Use 10 pt Times New Roman, *Italic*, *Cap/lowercase*, centered. Put the same superscript symbols *, †, ‡, §, or # before affiliation of the corresponding author. Start each affiliation/address as a new paragraph and separate them by a semicolon.

Drop 36 pt

Write the word "**Abstract.**" by 10 pt Times New Roman bold and include in the same paragraph the abstract using 10 pt Times New Roman, justified. Indent 1 cm spaces from the left and right margins. The abstract should be clear, descriptive, self-explanatory and not longer than 200 words.

Drop 36 pt and begin text. **Use 12 pt Times New Roman throughout the text.**

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Three levels of headings are available. Format the headings in your paper as follows:

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Make your equations clear and legible, centered, with a 6 pt space above and 6 pt below. Equations should be the same size (12 pt) as the text. Place each equation on a separate line and number equations sequentially. Enclose the equation number in parentheses, and place it flush with the right-hand margin. Use Eq.(n) (n=equation number) for referring to the equation.

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Do not use footnotes. If necessary, incorporate the corresponding information in the text.

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Refer to the American Institute of Physics (AIP) Style Manual, Fourth Edition (1990), for standard symbols and unit abbreviations. See the AIP website http://www.aip.org/pubservs/style.html We suggest that you use the International System of Units (SI units). Define any acronyms the first time you use them, in a parenthetical description following the acronym.

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It is not possible to have figures printed in color. Do not use colors in your figures: this will reduce the print quality during black & white printing.

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Cite all illustrations in the text consecutively and place the figures as close as possible to their first mention in the text **at the top or bottom of the page** with **the figure caption positioned below.** When referring to the figures in the text, type the word "Fig. n" (n=figure number).

Number figures with Arabic numerals, and type the caption below the space for the figure. Each illustration must include a caption that clearly and succinctly explains its content. Illustrations are consecutively numbered in the text. Position the caption 6mm (1/4 inch) below the illustration. The caption should be the full width of the text area; if the caption runs shorter than the width, center the caption.

The caption format: Type the word ``**FIGURE n''** (n=figure number) in 10 pt Times New Roman, **BOLD CAPS** , followed by a period. Use 10 pt Times-Roman, Cap/lowercase for the caption text.

The space for the figure and its caption should be separated from the text by 6 mm distance.

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Tables should be typed within the text at the top or bottom of the page, close to where they are first cited. Be sure that the data are concisely presented and that any abbreviations used are defined. Number tables sequentially in the text. Format the tables as follows:

Body of table: 10 pt Times New Roman, centered.

Table column/row heads: 10 pt Times New Roman, **Bold**,**Cap/lowercase**, centered.

Number tables with Arabic numerals, and type the caption below the table. Each table must include a caption that clearly and succinctly explains its content. Tables are consecutively numbered in the text. Position the caption 6mm (1/4 inch) below the table. The caption should be the full width of the text area; if the caption runs shorter than the width, center the caption.

The caption format: Type the word ``**TABLE n''** (n=table number) in 10 pt Times New Roman, **BOLD CAPS** , followed by a period. Use 10 pt Times-Roman, Cap/lowercase for the caption text.

The space for the table and its caption should be separated from the text by 6 mm distance.

If a table is wider than the page, turn the table on the page (broadside) so the top of the table is on the left side of the page. Do not add text to a page containing a broadside table.

Acknowledgements:

Acknowledgments should be positioned at the end of the paper and before the reference section. Set the word "**ACKNOWLEDGMENTS**" as a first-level head (14 pt).

References:

As a first level head (14 pt), set the word "**REFERENCES**" . List and number all bibliographical references at the end of your paper. When referring to them in the text, type the corresponding reference number **between square brackets, e.g. [1].**

References should be written by 10 pt Times New Roman in the following form:

Paper presented at a conference: Last name(s) and initial(s) of author(s), "title of paper," name of publication, place of publication, publisher, year, inclusive page numbers. Example:

1. Chapelon, J.Y., and Cathignol, D., "High energy ultrasound therapy: Part I – High intensity focused ultrasound (HIFU)," in *Advances in Nonlinear Acoustics,*

Proceedings of 13th International Symposium on Nonlinear Acoustics, ed. by H. Hobaek (World Scientific, Singapore, 1993), 30-35.

Journal paper: Last name(s) and initial(s) of author(s), "title of paper," name of journal, volume number (bold), inclusive page numbers, year. Example:

2. Cleveland, R.O., *et al.,* "A dual passive cavitation detector for localized detection of lithotripsy-induced cavitation *in vitro*," J. Acoust. Soc. Am. **107**, 1745-1758 (2000).

Book reference: Last name(s) and initial(s) of author(s) or editor(s), book title (in italics), place of publication, publisher, year, chapter and/or inclusive page numbers. Example:

3. Olver, P., *Application of Lie Groups to Differential Equations* (Springer, New York, 1986), ch. 4, 133-145.
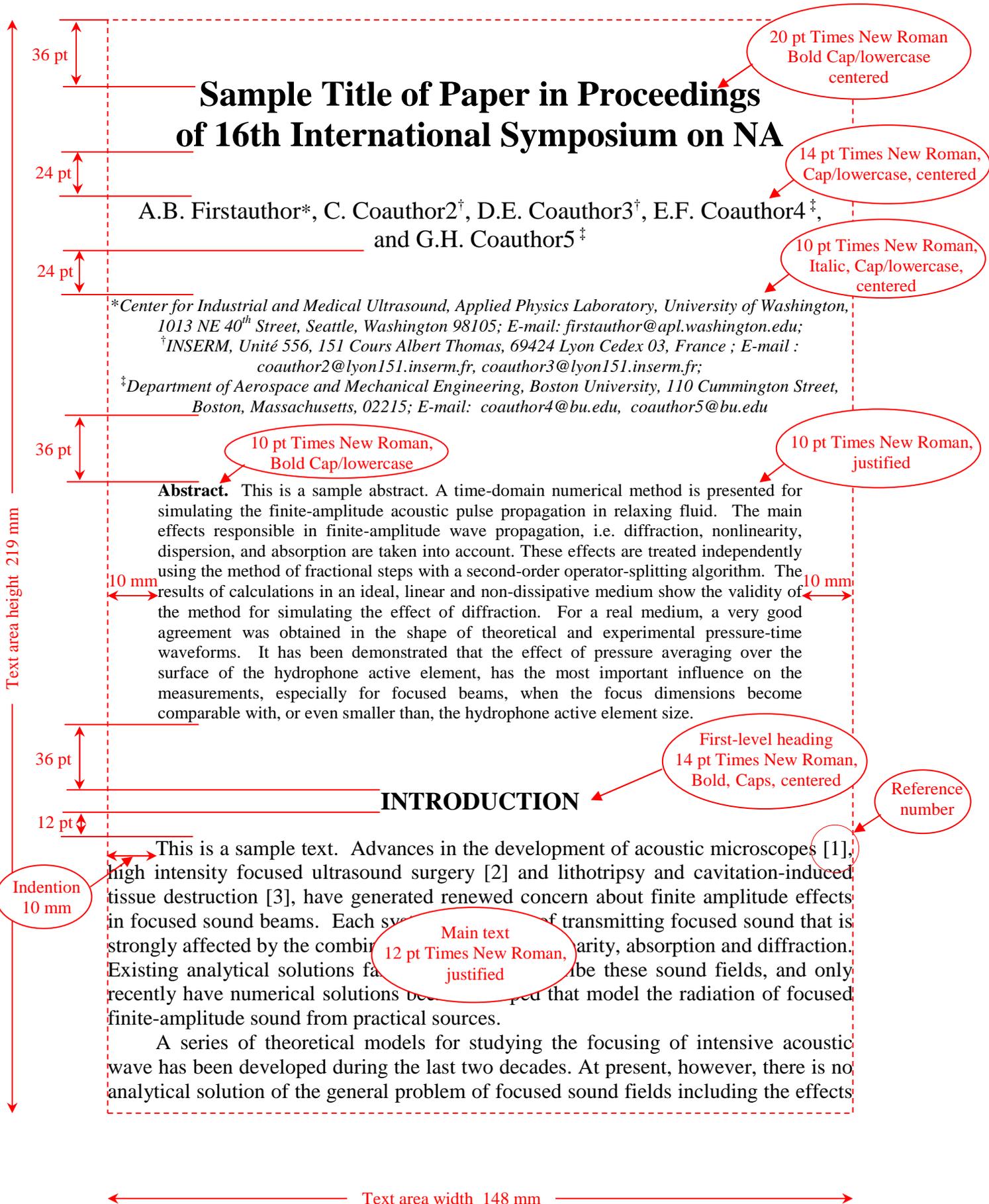
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Sample Title of Paper in Proceedings of 16th International Symposium on NA

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and G.H. Coauthor5 ‡

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Abstract. This is a sample abstract. A time-domain numerical method is presented for simulating the finite-amplitude acoustic pulse propagation in relaxing fluid. The main effects responsible in finite-amplitude wave propagation, i.e. diffraction, nonlinearity, dispersion, and absorption are taken into account. These effects are treated independently using the method of fractional steps with a second-order operator-splitting algorithm. The results of calculations in an ideal, linear and non-dissipative medium show the validity of the method for simulating the effect of diffraction. For a real medium, a very good agreement was obtained in the shape of theoretical and experimental pressure-time waveforms. It has been demonstrated that the effect of pressure averaging over the surface of the hydrophone active element, has the most important influence on the measurements, especially for focused beams, when the focus dimensions become comparable with, or even smaller than, the hydrophone active element size.

INTRODUCTION

This is a sample text. Advances in the development of acoustic microscopes [1], high intensity focused ultrasound surgery [2] and lithotripsy and cavitation-induced tissue destruction [3], have generated renewed concern about finite amplitude effects in focused sound beams. Each system is a means of transmitting focused sound that is strongly affected by the combined effects of nonlinearity, absorption and diffraction. Existing analytical solutions fail to adequately describe these sound fields, and only recently have numerical solutions been developed that model the radiation of focused finite-amplitude sound from practical sources.

A series of theoretical models for studying the focusing of intensive acoustic wave has been developed during the last two decades. At present, however, there is no analytical solution of the general problem of focused sound fields including the effects

of diffraction, nonlinearity and absorption. A model which seems to be best suited to the study of moderately focused acoustic beams and which accounts for diffraction, nonlinearity and absorption is based on the Khokhlov-Zabolotskaya-Kuznetsov (KZK) parabolic equation [4, 5]. Although the model is apparently valid for arbitrary source conditions, their investigations of focused sound are limited to system diffraction effects are relatively weak and focusing gains are relatively lo of computer codes has been proposed to solve the KZK equation numerically.

EXPERIMENTS

Materials and Methods

High-Speed Photographing

This is a sample text. Cavitation in the water tank was filmed with Ektapro 4540 high-speed digital camera (Eastman Kodak Company, Rochester, York) at a rate of 40,500 frames per second (i.e., each frame was exposed for 25 μs). We used a 24 - 120-mm lens with and without a 2x-magnifying lens. The focal area was backlit with a 1000-W lamp and was filmed through the acrylic wall of the tank. The sensor had 64x64 pixels, and images were presented in 256 grayscale levels. The 10-mm or 20-mm square images (30-mm depth of focus) captured the cluster of bubbles growing and collapsing along the lithotripter axis which ran from lower right to upper left in the image. Images were stored on VHS videotape. Video images were digitized from videotape and analyzed with NIH Image (Bethesda, Maryland) on a Macintosh G3 computer. The images were acquired with an Imacon 200 high speed camera (DRS Hadland, Cupertino, California, USA) and stored digitally. A 1000-J flash lamp provided lighting from the front, and exposure times were 100 ns.

The camera has a maximum frame rate of 40,500 frames per second and stores up to 5120 full frames in memory. The size of each frame at the maximum framing rate is 64x64 pixels. In these experiments, the focal depth was 3 cm and the image area was 9 mm by 9mm except in the preparation of Fig. 1 where the image was 100 mm by 100mm. The camera was triggered with the photodiode and operated simultaneously with the dual PCD system, see Fig 2.
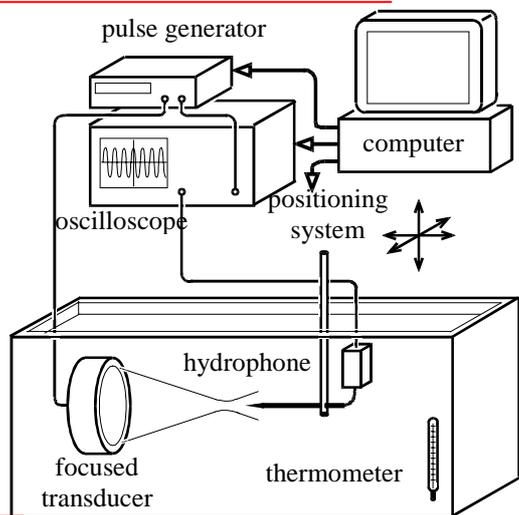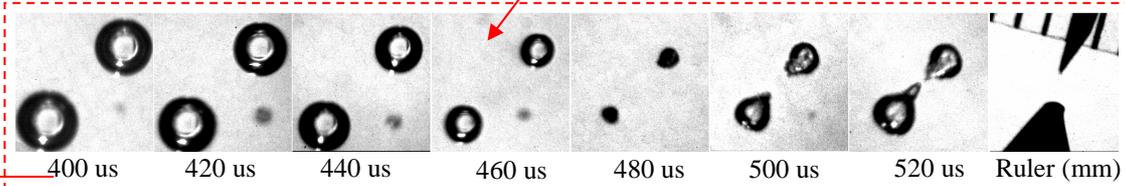

FIGURE 1. This is a figure caption. It should be 10 pt Times New Roman. The caption should be the full width of the text area; if the caption runs shorter than the width, center the caption.

| 400 us | 420 us | 440 us | 460 us | 480 us | 500 us | 520 us | Ruler (mm) |

FIGURE 2. This is a sample caption. Neighboring bubbles send their jets towards each other.

The digital images obtained by the camera were stored on video tape and subsequently analyzed with NIH image. Video images were digitized from videotape and analyzed with NIH Image (Bethesda, Maryland) on a Macintosh G3 computer. The images in Fig. 2 were acquired with an Imacon 200 high speed camera (DRS Hadland, Cupertino, California, USA) and stored digitally.

Cavitation detection receivers

This is a sample text. Although, the dual PCD system consists of two focused receivers we first discuss the behavior of a single PCD receiver. The individual transducers used in this research were spherical caps of C-5400 lead zirconate titanium (PZT) (Channel Industries, Santa Barbara, CA) with a resonance frequency of 1.08 MHz, aperture diameter of 100 mm, and radius of curvature (focal length) of either 100 mm or 200 mm. The PZT elements were mounted in stainless steel housing and were air-backed. This is a sample text. This is a sample text.

Experimental Results

This is a sample text. Fig. 2 shows results for cavitation measured at F2 for charging voltages between 12 kV and 24 kV. Both the characteristic time (t_C) and collapse pressure (p_{C2}) are plotted. Twenty shock waves were fired at each location. The data for shots where a coincident event was detected is marked by a '+'. The solid line shows the mean value of the data. Presenting the data in this manner allows trends to be observed and at the time same provides the number of events that occurred and the scatter in the data. It can be seen that for both lithotripters there was an almost monotonic increase in the radiated pressure. This is a sample text.

THEORY

This is a sample text. The basic equation of the nonlinear theory of acoustic beams propagating in medium with general type nonlinearity is KZ equation:

$$\frac{\partial}{\partial \tau}\left[\frac{\partial u}{\partial z} + P(u)\frac{\partial u}{\partial \tau}\right] = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \ , \tag{1}$$

where u is function describing the waveform, τ is retarded time, z is a coordinate along the beam axis, and x and y are the transverse coordinates. Eq.(1) is written in the form

Symmetry no.	φ_0	φ_1	φ_2	φ_3	ψ	η
0	x_0	x_1	x_2	x_3	w	0
6	0	$x_3/2$	0	x_0	0	0
7	0	0	x_3	$-x_2$	0	0
8	0	0	0	0	$\Phi(x_0,x_2,x_3)$	0

TABLE 1. This a sample table caption. Tangent vectors of the symmetry groups of the generalized KZ equation for an arbitrary from of nonlinearity $P(u)$. The function $\Phi(x_0, x_2, x_3)$ in the symmetry no.8 is an arbitrary solution of the Laplace's equation.

this is a sample text. Many of the symmetries given above are unknown previously for the 3D Khokhlov-Zabolotskaya equation. Up to now, the group analysis of the KZ equation has been conducted only for the case of a quadratic nonlinearity [4]. In this paper, the group classification of the KZ equation is performed for an arbitrary form of the nonlinear term; i.e. all possible point symmetries of the generalized KZ equation are calculated. This is a sample text. This is a sample text. This is a sample text.

CONCLUSIONS

This is a sample text. An ultrasound image-guided, localized cavitation detection and marking system was devised and tested. Cavitation was detected by dual passive cavitation detection.[1] Two focused receivers and coincidence detection allowed us to detect within the tissue and within the fluid of the collecting system. Two charging potentials were tested 18 and 24 kV. The time t_C, over which the bubbles grow and collapse, is slightly longer in tissue than in the collecting system, 562 ± 93 µs and 448 ± 76 µs at 18 kV and 745 ± 143 and 681 ± 112 at 24 kV. PCD signals as well as hyperecho in the B-mode ultrasound image were detected more readily in the collecting system than in tissue.

ACKNOWLEDGEMENTS

REFERENCES

1. Chapelon, J.Y., and Cathignol, D., "High energy ultrasound therapy: Part I – High intensity focused ultrasound (HIFU)," in *Advances in Nonlinear Acoustics,* Proceedings of 13th International Symposium on Nonlinear Acoustics, ed. by H. Hobaek (World Scientific, Singapore, 1993), 30-35.

2. Cleveland, R.O., *et al.,* "A dual passive cavitation detector for localized detection of lithotripsy-induced cavitation *in vitro*," J. Acoust. Soc. Am. **107**, 1745-1758 (2000).

3. Olver, P., *Application of Lie Groups to Differential Equations* (Springer, New York, 1986)), ch. 4, 133-145.