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Regards,
Eric Funk, Ph. D.
Partner, Red Mountain Radio LLC
eric@redmountainradio.com
970-325-2158 ×12

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# RF phase-coded random-modulation LIDAR

M. Bashkansky [a,*], H.R. Burris [b], E.E. Funk [c], R. Mahon [d], C.I. Moore [a]

[a] Naval Research Laboratory, Code 5614, 4555 Overlook Avenue, SW, Washington, DC 20375, USA
[b] Research Support Instruments, Inc., 4325-B Forbes Boulevard, Lanham, MD 20706, USA
[c] Red Mountain Radio LLC, 304 Sixth Avenue, P.O. Box 1056, Ouray Colorado, CO 81427, USA
[d] Jaycor, Inc., McLean, VA 22102, USA

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**Abstract**

We present a CW LIDAR utilizing telecommunications components and operating at eye-safe wavelength of 1550 nm. Our direct detection LIDAR relies on a pseudo-noise phase coded RF sub-carrier to perform range determination. We demonstrated a range resolution of 15 m at a distance of 16 km in fog using retro-reflectors.
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## 1. Introduction

It was previously recognized that pseudo-random sequences such as the M-sequence, and the A1 and A2 sequences could be used in CW LIDARS for range-gated detection [1,2]. These sequences enable the use of CW lasers that are more compact, less expensive and operate at much lower peak power than pulsed lasers. Additionally, CW LIDARS can operate in the 1550-nm wavelength range. Low cost reliable telecommunications components are readily available at this eye-safe wavelength. Currently, new coherent CW LIDAR architectures are being developed [3] based on fiber-coupled telecommunications lasers and erbium doped fiber amplifiers (EDFAs).

In a CW LIDAR architecture, an optical carrier is typically intensity or wavelength modulated with a known pattern. Range is then determined by measuring the delay between the transmitted and received modulation patterns. This has been demonstrated in direct detection CW LIDARS with on off keying by a pseudo-noise (PN) code [1]. These PN coded LIDARS rely on direct optical detection, and are, by nature, insensitive to optical phase. Hence, the phase shift keyed codes that are typically used in CW radio ranging and spread spectrum communications cannot be directly transferred to direct detection optical systems [4].

* Corresponding author. Tel.: +1-2027672512; fax: +1-2024048114.
*E-mail address:* bashkansky@nrl.navy.mil (M. Bashkansky).

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